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Windjammers still sail the seven seas as training ships. An article on page 66 describes these historic vessels

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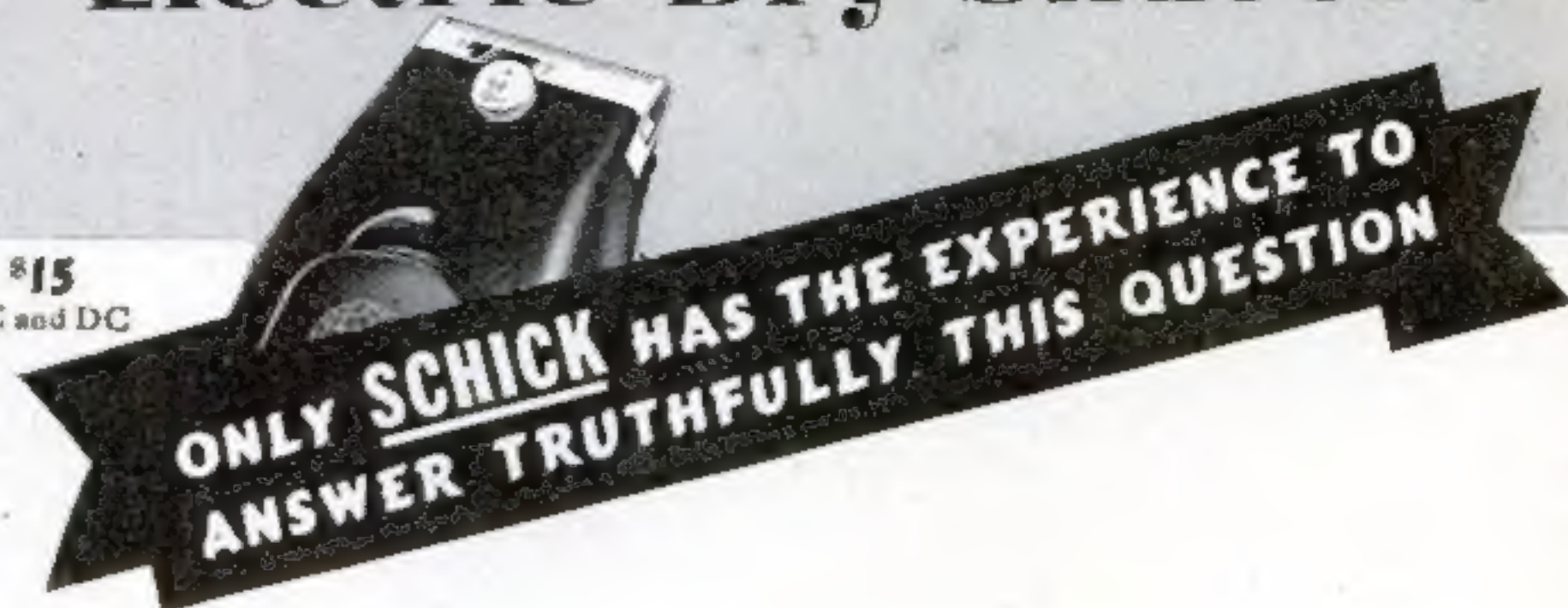
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Our Readers Say



Bug Collector Objects to Net-Wielding Line Bucker

MORE power to the football captain who takes his workouts chasing butterflies! If he goes tearing after them trying to catch them on the wing, comic-strip style, he must get plenty of exercise in broken-field running. Maybe he's good enough to pick a butterfly out of the air like a forward pass. Collectors that I know, however, prefer to wait till the critter lights and then sneak up and pop the net over it. The football captain's method will get him more exercise than insects!—S.D.H., Point Pleasant, N. J.



One Issue for Each Hobby Is His Suggestion

YOUR new modern type, as used in the last few issues, certainly has made your magazine a finer, easier-to-read book. I enjoy every issue. The letters from various hobbyists, each asking you to devote more space to his own special subject, have given me an idea. Why not put out a special issue for each hobby? That is, in any one month, instead of having a radio department, microscopy page, and chemistry article, turn all this space over to just one subject. One month it would be chemistry, the next, radio, and so on. In this way, all of the hobbies are put on a big scale, and each is given the special notice that it deserves. If the thing were handled in this way, all the clamoring hobbyists would get what they want.—L.F., Jr., Baltimore, Md.

Wants a Lens To Focus Short-Wave Broadcasts

FRANKLY admitting that I know little of physics, even though I am continually interested in various natural laws, I would like to submit this question, which is one of several that have been on my mind for some time. Perhaps other readers can find an answer to it. A glass lens can be made to focus light. Why cannot a lens be made that would focus a short-wave radio broadcast? There must be some substance, I think, through which these waves will be deflected when they pass through, and if a piece of such a substance were properly shaped, it would enable the waves to be sent out in a parallel beam like that of a spotlight, thus enabling messages to be sent over longer distances, with less dispersal of the radio waves where they are not needed.—A.P., Youngstown, Ohio.

HOW ABOUT A TELEGRAPH WIRE?



A Gem Among Hobbies Is Stone Cutting

WOULDN'T you please try to give more hints for amateur lapidaries? Personally, I would like to know a whole lot more about the work than was contained in the excellent articles you have already published. If you can give us more hints on stone cutting, especially on setting up a good outfit in a small space, I would appreciate that information.—C.S.M., Pierce City, Mo.

Thinks Human Hair Would Toughen Automobile Tires

ANOTHER reader asked, "Where does rubber go when it wears out?" I can't answer that question, but I would like to make a suggestion. It should be possible to work human hair into the rubber when the tires are made. Hair, being elastic, as well as strong, would increase the durability of the tires. This would probably make them wear as much as twenty-five percent longer. Tons of hair clippings are thrown away by barber shops every year, so there would be little trouble in finding a source of supply for the hair—J.H.V., Farmingdale, N. Y.

BUT IT'S GONNA BE WORTH MONEY!



Amateur Chemists Swap Ideas and Chemicals

WE HAVE an amateur chemist's club in our city through which we exchange ideas and swap chemicals. What I would most like to see in your articles on chemistry is more about analysis of everyday substances. We all are interested in knowing the chemical composition of the foods we eat and the various other preparations that enter into our daily lives.—L.T.K., Swift Current, Sask., Canada.

He Sees Stars Better From Corner of Eye

IN YOUR article, "Don't Believe Your Eyes," mention was made of the stroboscopic effect that sometimes makes moving objects appear to stand still. I have never noticed this illusion, but have seen a similar one. While sitting or standing perfectly still, and watching out of the side of my eyes, I have seen a moving fan slow down, but never stop completely. Another illusion that puzzles me is this: as an amateur astronomer, I often want to make out the details of some faint star, and I find that I can see it better out of the corner of my eye. That is, I center my gaze at a point forty-five degrees away from the

star. Perhaps this is an individual characteristic, because I wear glasses for short-sightedness, and find that I can do many things with my eyes that other people are unable to accomplish.—D.P., Sydney, Australia.

Baking-Soda Chemistry Is Not for Him

PLEASE give us more chemistry. Not baking-soda chemistry, but real, honest-to-goodness articles that teach, as well as demonstrate on a small scale the numerous processes and methods used in industrial plants. I would like to know more about the reactions that go on in the analysis of iron, steel, food, and soil, as well as in the preparation of organic and inorganic compounds. Let's do away with pickle-bottle apparatus. All it does is take up valuable space and time. If we are going to perform real experiments, we must have real equipment.—P.B., Buffalo, N. Y.

YOU'N ME BOTH, KID!



They're Still Harping on Electric Organs

A FEW months ago, another reader requested a few articles dealing with electric organs, and ever since then, I have been waiting for them. But alas, no luck! With all the advancement made in the line of organ construction, I'm sure there must be plenty of facts to make interesting reading. What is the secret of these beautiful tones produced without pipes or reeds? By the way, I enjoyed "Musical Magician" a lot. Let's have more articles like this, too.—J.D.V., Philadelphia, Pa.

Sounds Like a Trick You'd Do With Mirrors

I AGREE with those readers who think Our Readers Say is not the least interesting section of an exceedingly interesting magazine, and I'd like to contribute this little problem, which, while not mathematical, is a test in deduction for the amateur Sherlock Holmes. Three men applied for a job in a detective agency. The manager, who could hire only one, gave them this test: He showed them five disks—two white, and three black. Then, sticking one disk on each man's forehead, he placed the applicants in a room and promised the (Continued on page 8)

IF YA WAS DOWN IN A COAL MINE THEY'D ALL BE BLACK!



Light Conditioning IS HERE!



In the above photo, the Home Lighting Advisor is using a Light Meter to measure the amount of light from an I. E. S. Better Sight Lamp. She is holding the Light Meter at the place where seeing tasks are done. A close-up of the Light Meter is also shown. The printed dial indicates how much light a lamp is giving and whether it is enough for easy seeing without eyestrain.

How the new scientific use of Better Light for Better Sight is helping to relieve eyestrain . . . bringing better working conditions and new joy in living to young and old alike in millions of homes, stores, offices, factories and schools.

IN the few short centuries since mankind moved indoors, civilization has laid heavy burdens on our eyes . . . and with appalling results. One child in five in our public schools, 40 college students in a hundred, and half the people over 35 have defective vision! These are average U. S. figures, according to reliable estimates.

The kindly and skilful services of eyesight specialists have done much to correct or relieve these eye troubles . . . but not until the last decade has science pointed the way to proper lighting for our modern, complex seeing needs. There is nothing mysterious about Light Conditioning. It is simply providing the right amount of light and the right kind of lighting for Seeing, Comfort and Beauty, wherever eyes are used in work or play. And the day is fast approaching when Light Conditioning will be as common as good plumbing.

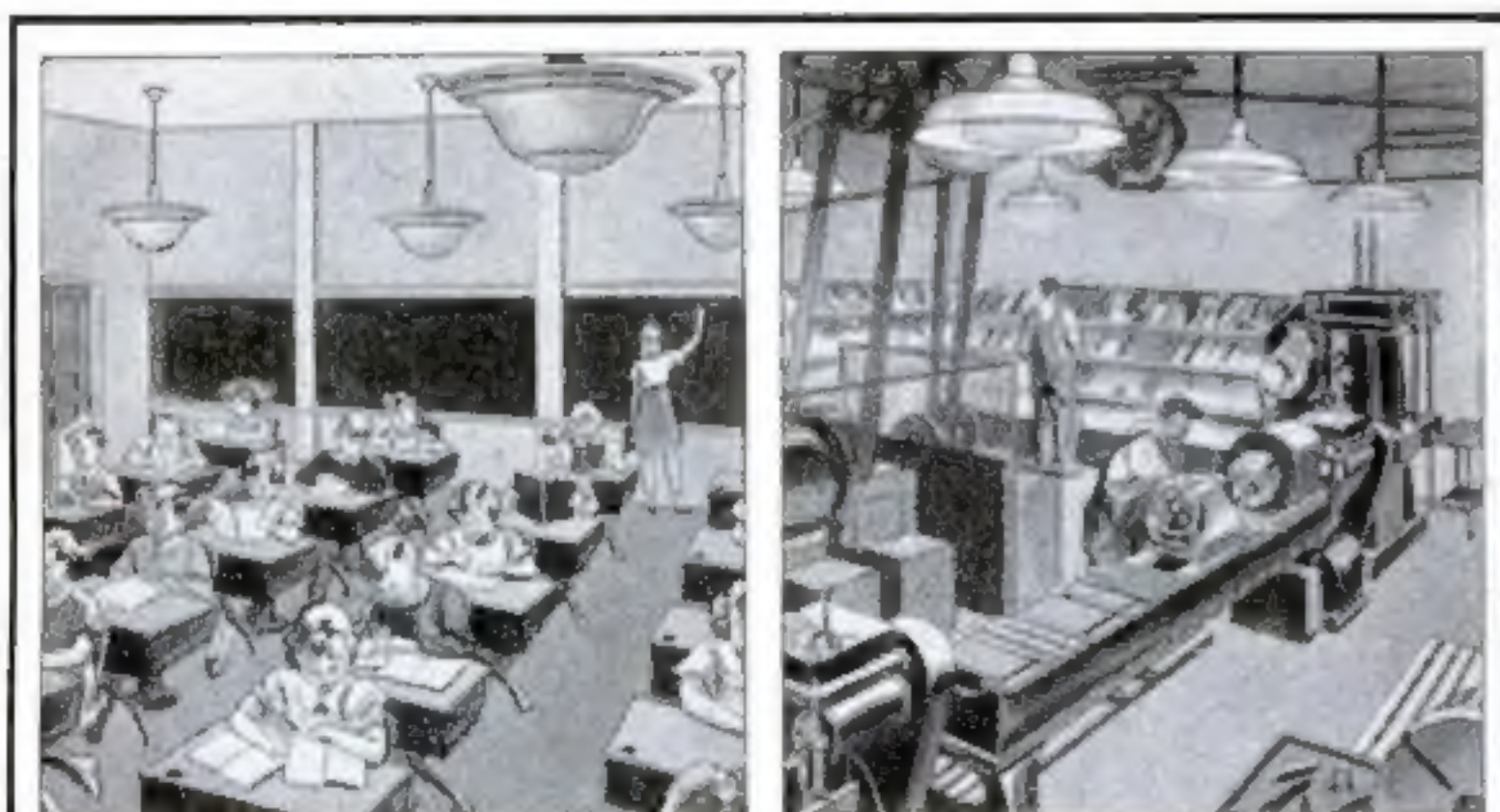
Light Conditioning is going on all around you. You might be amazed to know that there are more than 5,000 Light Conditioning experts at work today, measuring and studying the lighting in homes, schools, offices, factories, stores and public buildings. Nearly every electric service company has on its staff one or more of these trained experts, whose services are offered to the community free of charge.

For as little as 15c or 20c you can take the first real step toward a Light Conditioned home! One new 1937 G-E bulb of the proper size—in the right place—will make a surprising difference. And the new 1937 G-E bulbs give more light at no additional cost for current!

The new I. E. S. Better Sight Lamps help solve the Light Conditioning problem because they are designed to give several times as much useful light as ordinary lamps.

FREE NEW ILLUSTRATED BOOKLET

Just off the press! General Electric's new free booklet tells exactly what you want to know about Light Conditioning. Gives easy, practical and inexpensive ways to make seeing easier and safer for your family. Send for your free copy. Address General Electric Co., Dept. 166PS, Nela Park, Cleveland, Ohio.



Carefully conducted experiments prove that Light Conditioned schoolrooms help children get better marks, by enabling them to see and understand things better.

Light Conditioning helped a Cleveland factory increase night production so that total production was up more than 26% and overall spoilage down 30%.



THE FIRST STEP IN LIGHT CONDITIONING . . . CHANGE TO THE NEW AND BRIGHTER MAZDA LAMPS MADE BY

GENERAL  ELECTRIC



WORKMAN AND HOMECRAFTSMAN AGREE

It's a pleasure to buy files this new way! "I never did like to wait while the clerk hunted the file I wanted—the Self-Service Display saves me lots of time," says the carpenter * * "I'm particular about the files I buy," the hom craftsman adds. "The cellophane wrapping lets me tell at a glance." * * No more searching through boxes . . . no more unwrapping yards of brown paper . . . alert hardware stores



in your community now have popular sizes and types of fast-cutting Nicholson or Black Diamond Files, cellophane wrapped in this colorful, convenient display unit. Nicholson File Company, Providence, R. I., U. S. A.

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A FILE FOR EVERY PURPOSE

(Continued from page 6)

job to the first one who came out and announced the color of the disk he was wearing. In a few minutes, one of the men emerged, and said, "My disk is black, because the other two are black." What were his deductions to arrive at this conclusion?—J.A.M., London, England.

Make-Up Question Plagues Home-Movie Producer

MY REQUEST concerns amateur movie photography, a subject on which you have published much useful information in the past. In a future issue, I would like to see an article telling how one could rig up a sound-recording machine for home movies, if such a thing is practical for amateurs. Also, would you mind telling us a few things about how to produce our own feature pictures? Making up the actors, getting good camera angles, and photographing close-ups all are problems that come up in this connection.—A.A.P., Fitchburg, Mass.

IVE GOT MY MAKEUP
ON, LETS
GO!



Radio Hams: Try This Problem

SUPPOSE we arranged two radio-transmitting stations so the loudspeakers of their receivers pointed right at the microphones. Each receiver would be tuned to the wave length of the other station's transmitter. Now, if we made an announcement into one of the microphones, what would happen? Would the words keep repeating themselves from receiver to transmitter, and so on, indefinitely? Would the signal fade out in time? Or, in spite of the way the loudspeakers and microphones are arranged, would the signal be instantaneous?—H.A., Long Beach, N. Y.

Monthly Flight Column For Model Aviators

OUR local model-airplane club, which consists of ten members, recently analyzed your magazine and concluded that only one thing was lacking, namely, a model-airplane department. Why not inaugurate a special section devoted to modelmaking hints, and, occasionally, plans for a real flying model? In addition, it occurred to us that "Popular Science of the Screen" might show how the model-airplane hobby is progressing, by filming contests and showing the activities of clubs.—N.G.D., Albany, N. Y.

好杂志 (MEANING, IF IT WAS
IN CHINESE IT WOULD
BE A GOOD MAGAZINE!)



Why Telescope Mirrors Are Made of Glass

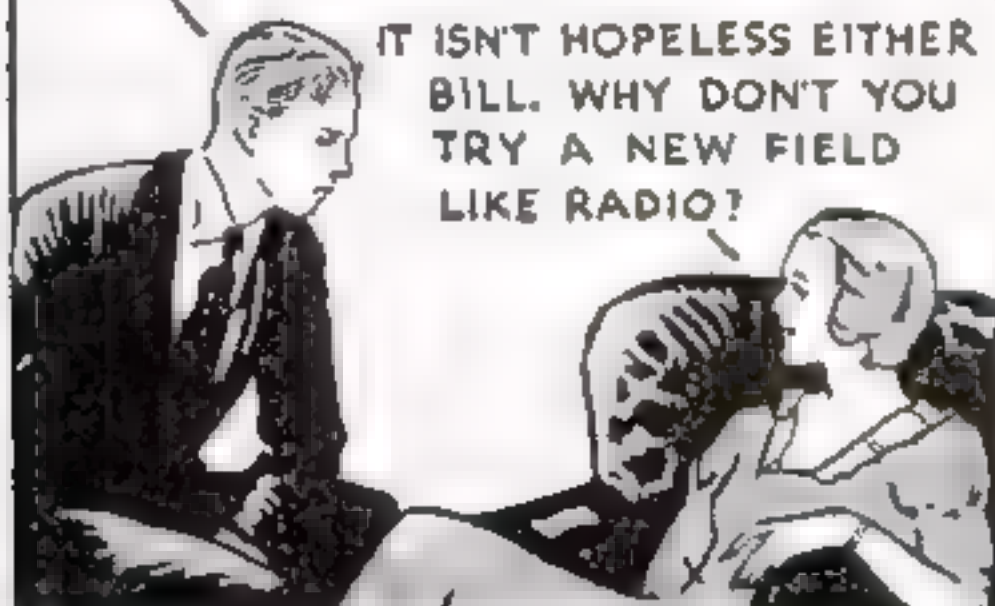
TELESCOPE mirrors, a reader suggests, might be made of metal instead of glass. This is not a new idea. In fact, the first reflecting telescopes did have metal mirrors, but this material was soon found to be unsatisfactory and discarded in favor of glass. First of all, glass can be ground to a greater degree of accuracy than the metal. This is important because tiny defects in the (Continued on page 10)

HE THOUGHT HE WAS LICKED—THEN

A TIP GOT BILL A GOOD JOB!

MY RAISE DIDN'T COME THROUGH MARY—I MIGHT AS WELL GIVE UP. IT ALL LOOKS SO HOPELESS.

IT ISN'T HOPELESS EITHER BILL. WHY DON'T YOU TRY A NEW FIELD LIKE RADIO?



TOM GREEN WENT INTO RADIO AND HE'S MAKING GOOD MONEY, TOO. I'LL SEE HIM RIGHT AWAY.



BILL, JUST MAILING THAT COUPON GAVE ME A QUICK START TO SUCCESS IN RADIO. MAIL THIS ONE TONIGHT



TOM'S RIGHT—AN UNTRAINED MAN HASN'T A CHANCE. I'M GOING TO TRAIN FOR RADIO TOO. IT'S TODAY'S FIELD OF GOOD PAY OPPORTUNITIES

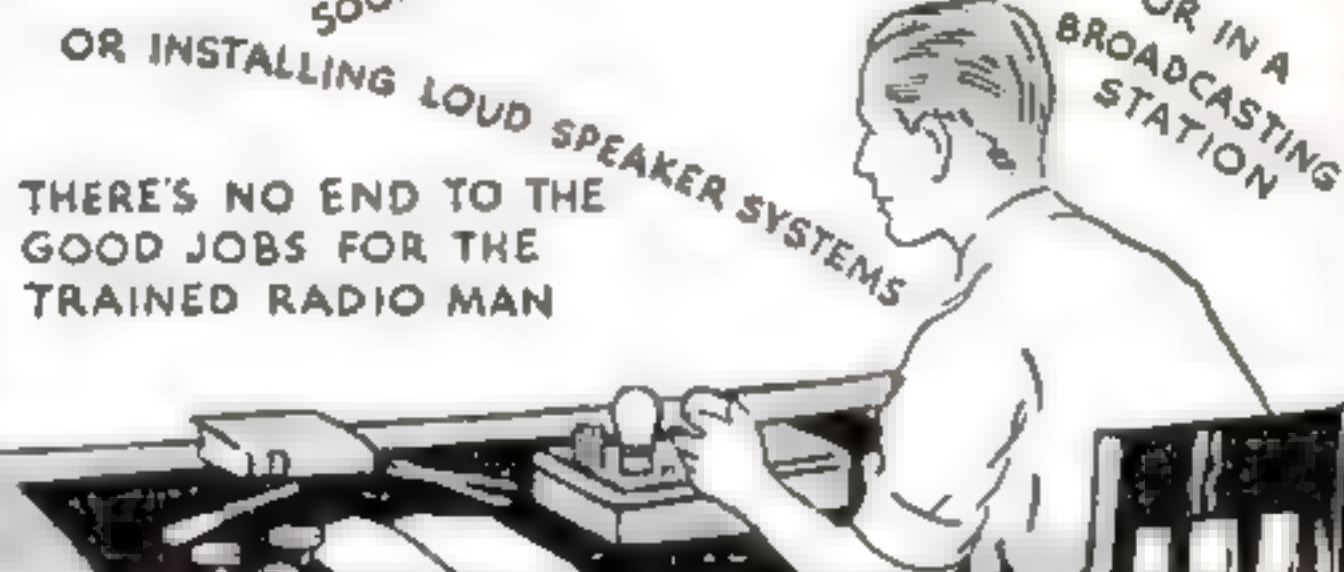


TRAINING FOR RADIO IS EASY AND I'M GETTING ALONG FAST--

SOON I CAN GET A JOB SERVICING SETS--

OR INSTALLING LOUD SPEAKER SYSTEMS

THERE'S NO END TO THE GOOD JOBS FOR THE TRAINED RADIO MAN



YOU SURE KNOW RADIO—MY SET NEVER SOUNDED BETTER

THAT'S \$15 I'VE MADE THIS WEEK IN SPARE TIME

THANKS!



I HAVE A GOOD FULL TIME RADIO JOB NOW--AND A BRIGHT FUTURE AHEAD IN RADIO

OH BILL, IT'S WONDERFUL YOU'VE GONE AHEAD SO FAST IN RADIO.



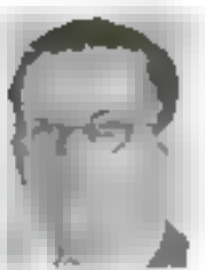
HERE'S PROOF THAT MY TRAINING PAYS



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"When I had completed the first twenty lessons I had obtained my license as Radio broadcast operator and immediately joined the staff of WMPC, where I am now chief operator."—HOLLIS F. HAYES, 85 Madison St., Lapeer, Mich.

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"I am making from \$10 to \$25 a week in spare time while still holding my regular job as a machinist. I owe my success to N. R. I.—WM. F. RUPP, 203 W. Front St., West Conshohocken, Pa.

\$3,500 a Year in Own Business



"After completing the N. R. I. Course I became Radio Editor of the Buffalo Courier. Later I started a Radio Service business of my own, and have averaged over \$3,500 a year."—T. J. TELAAK, 657 Broadway, Buffalo, N. Y.

Over \$1,000 Before Graduating



"Before completing half the N. R. I. Course I was servicing sets, and I made \$1,000 to \$1,200 before graduating. I am doing Radio service work for myself now."—ASHLEY G. ALDRIDGE, 1228 Shepherd St., Petersburg, Va.

I'LL TRAIN YOU AT HOME In Your Spare Time For A GOOD RADIO JOB

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Many Make \$5, \$10, \$15, a Week Extra in Spare Time While Learning

Almost every neighborhood needs a good spare time serviceman. The day you enroll I start sending Extra Money Job Sheets showing how to do Radio repair jobs. Throughout your training I send plans and ideas that made good spare time money for hundreds. I send Special Equipment to conduct experiments, build circuits, get practical experience. I GIVE YOU A COMPLETE, MODERN, PROFESSIONAL ALL WAVE, ALL PURPOSE RADIO SET SERVICING INSTRUMENT TO HELP SERVICE SETS QUICKER—SAVE TIME, MAKE MORE MONEY.

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J. E. SMITH, President, Dept. 7MP3
National Radio Institute, Washington, D. C.

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National Radio Institute, Washington, D. C.

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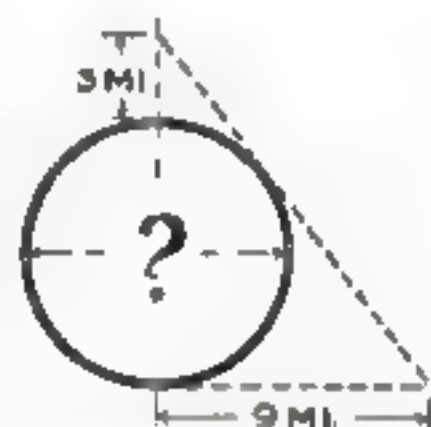
Our Readers Say

(Continued from page 8)

surface of the mirror will cause the formation of a poor image. Also, while metals expand and contract considerably under the effect of heat and cold, thus altering the shape of the mirror, glass expands so little that the effect of temperature is negligible. The same reader also says that a glass mirror cannot be focused accurately at any definite point. This is true of all spherical mirrors, regardless of their material. If the mirror is ground to a parabola, however, it can be focused accurately, whether it is glass or metal. Clear quartz is the only material considered better than glass for making optical instruments.—D.W.C., Simsbury, Conn.

A Circular City Wall Has This Reader Cornered

Here is a problem that I was confronted with recently. I would like to see how the puzzle enthusiasts of *Our Readers Say* solve it. A certain city has a circular wall around it, and in this wall are four gates, pointing north, south, east, and west. A house stands outside the city, three miles north of the north gate, and it can just be seen from a point nine miles east of the south gate. The problem is to find the diameter of the wall that surrounds the city. Can any reader solve it?—J.J., Norwood, Mass.



Old Camera-Film Spools Make Good Stirring Rods

B. H. E. wants a use for old film spools. I toss them into a box and keep them handy in the darkroom. When I'm making up a trayful of developer or hypo, I snap off one metal end of a spool in a convenient crack between two beams, and use the wooden stick as a stirring rod. The remaining metal end makes a perfect handle for applying pressure in crushing chemicals. Once I had the temerity to submit the idea to a photographic magazine and was sternly told, "The use of wooden stirring rods is filthy and dangerous." Perhaps I hadn't made it clear that I use a clean, fresh one each time.—C.K.G., Newark, N. J.

Hub-Cap Reflectors Make Trailer Safer

HAVING lived in a house trailer for several years, and yanked it over roads at all hours of the day and night, I find one problem uppermost in the trailerite's mind: Will other motorists know I have a trailer in tow when they come from a side road at night? It's easy to talk about putting lights on the sides of the trailer, but there's a limit to the juice the car's battery can deliver. The best solution I have found is to use plenty of reflectors along the sides. Besides these, I have put three small reflectors, of the type used on license plates, on each hub cap. When the wheels are turning, they make a good flash. I would prefer one big reflector on each hub, but have been unable to purchase any that are suitable. I think this would be a good item for stores to sell—a hub cap with built-

In reflector, not only for trailers, but for cars, too. Or, it might be more practical to offer a reflector designed to be screwed to the hub cap of a car in such a way that it would not interfere with the grease cup inside.—G.E.H., Tucson, Ariz.

We Don't Know What To Do With the One We've Got

A REFLECTING telescope was requested by another reader recently, and I would like to second his motion. Of course, I don't expect that you will print these plans just for the benefit of two readers, but if you do find room to publish them, I promise to find a new planet and give you sole rights to it.—R.E.F., Wildwood, N. J.



"Just Step Into My Darkroom" Said Our Reader to the Fly

Two other readers recently gave their theories as to the reason a fly evades the swatter so easily. One said the fly felt the heat of one's approaching hand, while the other held that it was the rush of air currents in front of the swatter that warned the insect. The fly's elaborate compound eyes, it seemed to me, were his real defense, and so I decided to try an experiment. Being a photographer, I am accustomed to working in the dim red light of a darkroom, but the flies, it seems, are not. I lured the insects into my darkroom with ammonia, and soon had plenty to experiment with. (Incidentally, the success of this bait seems to show that flies are attracted to decaying garbage by the odor of ammonia gas given off from the refuse.) When I turned off all the lights except the dim, red lamp used in developing, I found that the flies could be picked up readily between the fingers, a feat that would be impossible in ordinary light. This, I think, shows that flies are warned of danger by seeing it, not by air currents or heat. As a matter of fact, if a fly lights on your hand, and you blow on it, often the air current will only cause the insect to cling more tightly than ever.—C.T.T., Peoria, Ill.

Putting Engine at the Side Turns Car Into a Crab

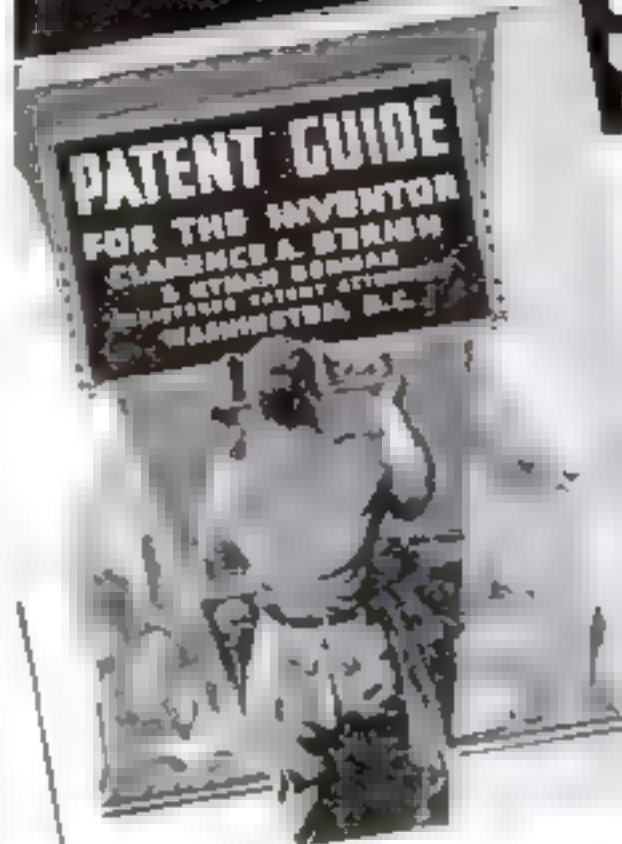
MAY I put a hand into the controversy as to whether a car pulls or pushes itself out of a hole? Perhaps I will get my fingers burnt. It seems a rather silly argument, because it makes no difference if the car pulls or pushes, just so long as it does get out. If the location of the power plant were the only thing that counted, imagine a car that had the engine mounted on a special frame off to one side, with the power applied to the rear wheels in the normal manner. This is not an impossible mechanical feat. If a car so constructed, with the engine at the side, got stuck in a deep mud puddle, would it be said to move out of the hole sideways?—R.C.M., Erie, Pa.

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CONTEST RULES

Only letters from bonafide home study school students will be considered and these must contain the name of the school and the name of the company, or companies, for whom you have worked since graduation. (Names, however, will be deleted from the letters when published.) We also want to know the kind of course you took and the type of position you have held. Your own identity will be kept anonymous, if desired.

We are interested in facts, not literary ability, but please write clearly, completely, and keep your letters within 750 words. We are not looking for "get-rich-quick" stories or freak adventures, and authors must be prepared to substantiate the truth of the statements. Manuscripts submitted and printed become the property of this magazine, and we are not responsible for the return of rejected stories unless sufficient postage is provided for this purpose. Address your contribution to Success Story, 353 Fourth Avenue, New York, N. Y.

FROM LAUNDRY WORKER TO CITY POWER SUPERINTENDENT THROUGH HOMESTUDY

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"I had worked at the laundry for two years when I heard of a job as assistant engineer in the local light plant. The plant was a small privately owned concern operated in conjunction with a woolen mill. The pay wasn't high, but here was a chance to get some practical experience in the electrical field. I applied for the job and was accepted.

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Secrets of Success

Before long I was appointed engineer, and began immediately to work on a correspondence course in electrical engineering.

"In 1916, the city bought the light plant and planned to operate it as a municipal enterprise. I applied for the job and, largely on my record with the Correspondence School, was elected superintendent. I completed the course shortly before beginning my new duties. When the city bought the plant it was in bad state of repair, and it was decided to spend quite a large sum in re-equipping the plant and extending the service. The same year, 1916, I was made Superintendent of the municipally owned water plant.

"I have served the city continuously since 1916, under three Republican and two Democratic administrations. When I became superintendent of the plants they were valued at about \$50,000. Today they are valued by the state tax board at approximately \$600,000. Our light and water rates compare favorably with cities of like size throughout the state, yet our city has been free from city taxation since 1932. All city expenses are paid from the earnings of our plants. Besides this, our city, thoroughly modern in every respect, does not have one penny of outstanding indebtedness. We have hard surfaced streets, street sweepers, garbage and ash collection, a white way lighting system, a modern fire department, and a new thoroughly modern filtration plant—all paid for from the earnings of our plants."

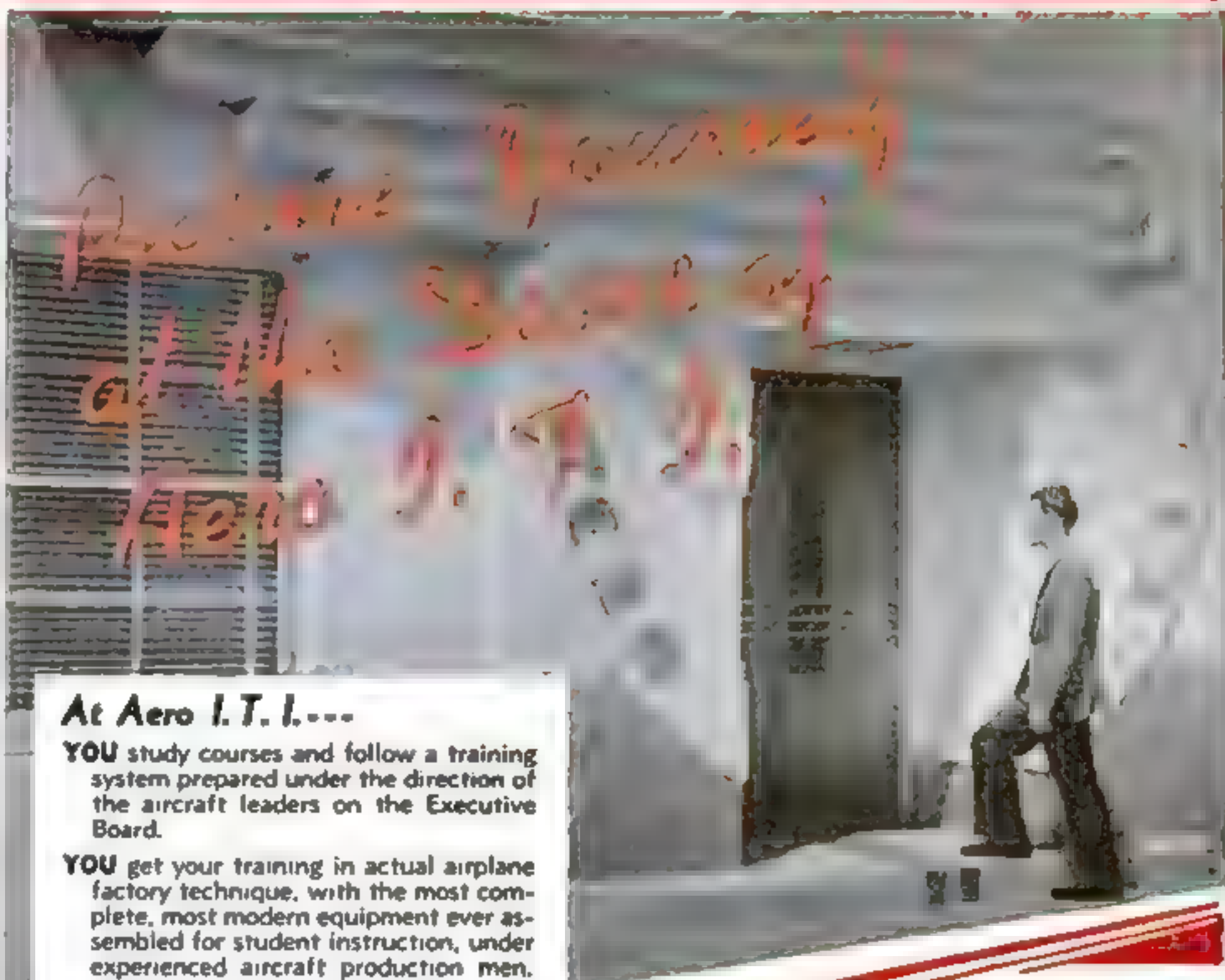
—L. G., Vincennes, Indiana

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AT THE age of 35 years—1922—with a sixth grade education I was working for _____ Company for \$20.00 per week. At the age of 37—1924—with a sixth grade education plus a correspondence course with _____ School I was Service Superintendent for _____ Company at \$200.00 per month. I have held three different jobs since then at from \$40.00 to \$60.00 per week. Have never been laid off for any cause since taking this course. Have been on the present job 8 years.

I have a number of offers every year, but as the present job is so near ideal I refuse them all even for more money.

There were times while working on this electrical course that I was so hard pressed for money that I almost gave up. With \$20.00 a week I had to pay rent, buy clothes and groceries, try to keep a girl and two boys in school. The wife and I did almost without. Thanks to one of the men at the correspondence school who kept after me, I kept trying and in August 1924 I received my diploma with an average grade of 95%. I am not a millionaire



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Secrets of Success

but am happy. My daughter went to college, one boy finished high school, and the other boy finishes high school this year.

Where and what I would have been now if I had not taken this course—I get the creeps to think about it. That electrical course spelled Success for me.

—G. H. M., Tallahassee, Fla.

HOMESTUDY WORTH 100 TIMES ITS COST TO D. E. G.

I **BEGAN** working in a school power plant after school at the age of 14. Due to sickness in the family I was not able to go to high school more than a year and a half. However after I had to leave school I worked for some time in the school plant. I went from there with my parents to a city in another state.

My parents were hardly settled in our new home when I visited the local power plant. The man in charge noted my interest and questioned me about my experience and before I left the plant I was given a job as night fireman and engineer. I was 17 at that time. I was at the plant about 6 months and then went to a near by city to work. The work was along other lines than power plant work and for some 2 years I went from one job to another. Presently I learned that the old job at the city light plant was open and I could have it if I returned.

Returning I was soon aware that if I was to be anything but a fireman I must gain a better knowledge of the steam power plant. I enrolled for a course in steam and electric engineering with the _____ School. I remained as night engineer at the little city light plant until it was shut down when taken over by a larger company.

From there my wife and I again went to a larger city, I went to a large central station, which is known as _____ Power & Light Company. I was there for several months and then leaving the position of an oiler I went to work for the _____ Oil Company, doing pipe work. I worked for the _____ Oil Company nearly a year which, along with my correspondence studies, gave me much good information. From this company, I went to a meat packing plant in Kansas. I was engineer in charge of a shift in that plant for about a year. From there I went to work for my present employer and have been with him for nine years. I am at present a boiler inspector for the _____ Company at about 3 times the salary I was getting when I enrolled with the _____ School. I feel that the correspondence course has paid me a return of about \$16,000.00 on an investment of \$_____. I am sure that had it not been for the **HOMESTUDY** secured through the _____ School I would not have my present position.

—D. E. G., Kansas City, Mo.

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Novel Gas Treatments Improve Fruit Trees

GAS ATTACKS now are used to make fruit trees produce regular crops in a new method perfected by U.S. Department of Agriculture specialists. Apple, peach, and similar trees often are affected by adverse winter conditions so they do not bear fruit at the usual times, resulting in heavy losses to the growers. Also, many trees tend to bear only on alternate years, producing a surplus one season and a scarcity the next. To regulate the growth, the process makes use of butylene, a common hydrocarbon gas. About two weeks before leafing time, the tree is completely enclosed in a large gasproof cover, and butylene is piped in until there is one part of the gas to each 100,000 parts of air. Trees treated in this manner for one or two hours are greatly improved in bearing quality, it has been found. The use of gas for stimulating plant growth is not new, but this is believed to be the first time it has been applied to large trees.

Animals Wear Boots To Prevent Infection

RUBBER BOOTS for cows, sheep, and other farm animals have recently been invented and tested by Sir Frederick Hobday, English veterinary surgeon, as a preventive measure against cankers, ulcers, and other foot diseases. Ointment applied to the hoofs and legs of afflicted animals is usually effective in treating diseases but it soon rubs off when the beasts are sent out to pasture. Disease germs are thus scattered where healthy animals may walk and become infected. Boots in the form of rubber cylinders are therefore slipped over the hoofs and legs of infected animals after the healing ointment has been applied, thus forestalling transfer of the malady from ailing to healthy members of a herd or flock.

Lockjaw Germs Found in City Streets

GERMS of lockjaw still are present in city streets, according to a series of tests of street dust recently made in Baltimore, Md., by Dr. Eric C. Giles. Tetanus commonly has been associated with horse manure, and with the almost total absence of horses from modern city streets, some physicians have thought it unnecessary to continue the precautions that formerly were taken against the dread disease when persons were injured in street accidents. Samples of dust taken from sixty-three places in Baltimore, however, indicate that the lockjaw germs still are present in large numbers, and that tetanus antitoxin still should be given to accident victims to obviate the possibility of their contracting lockjaw. This new discovery is expected to spur city health officials to renewed vigilance in combatting the dreaded infection.

"THEY KNEW ME WHEN..."



"I worked side by side with those men for years. I know them. They're my friends . . . and they're mighty fine chaps. But come back two years from today, and you'll see those same men at those same desks.

"They lack sufficient training to go much farther in this business. So did I — until I faced the cold, hard facts of my own case. It wasn't long after that that I enrolled as a student with I. C. S. The training I got in that course fitted me for advancement — and I've been on the up-grade ever since."

How about yourself? Are you honestly equipped to hold a bigger job? Think it over. The coupon below is the same one that started thousands of men toward success.

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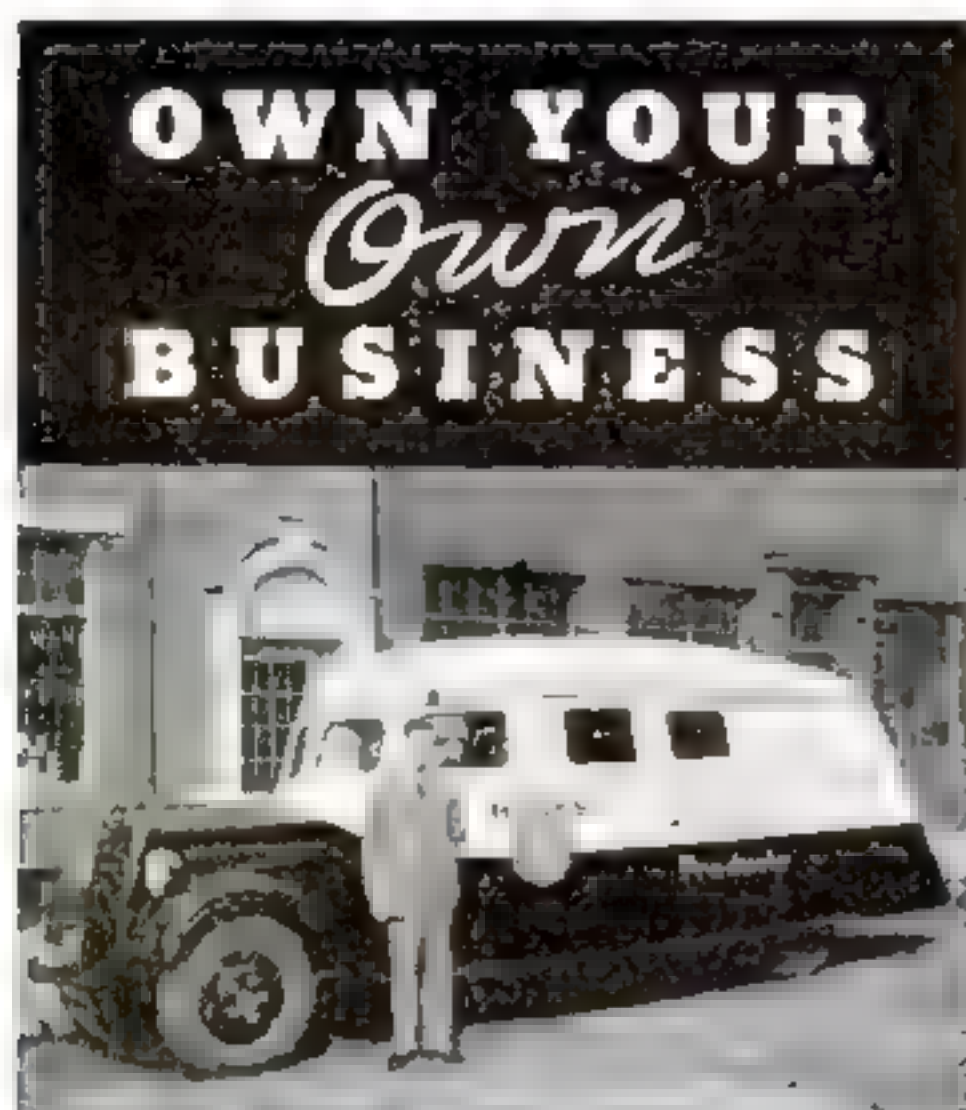
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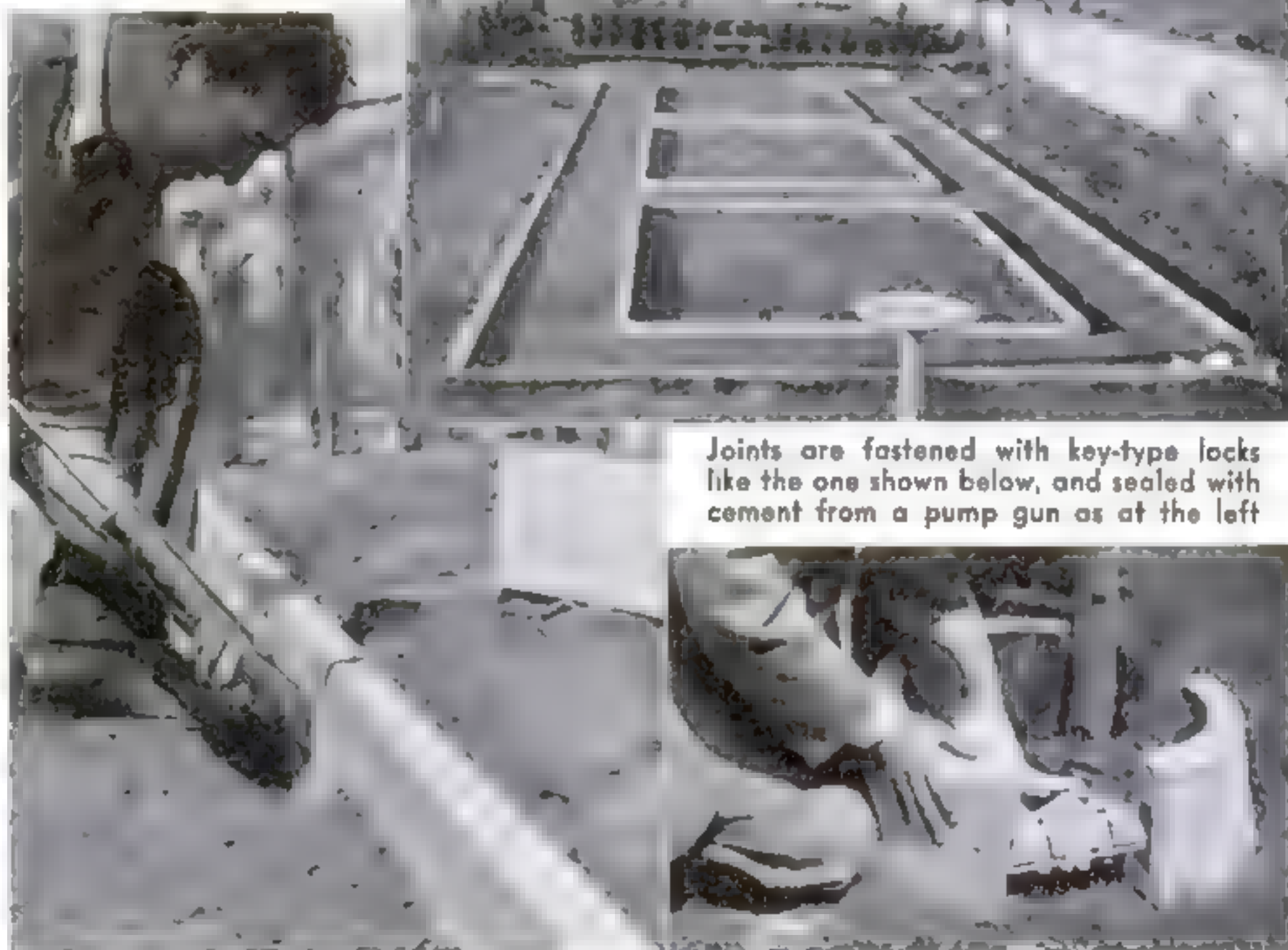


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New Ideas FOR HOME OWNERS

A formal garden laid out with the ready-made curbing. It is available in straight and curved sections



Joints are fastened with key-type locks like the one shown below, and sealed with cement from a pump gun as at the left

Novel Building Materials Shown

PREFABRICATED curbing, termiteproof house beams of steel and wood, and odd bricks with rounded corners were among the new home-building materials and supplies displayed at the California House and Garden Exhibition held recently in Los Angeles.

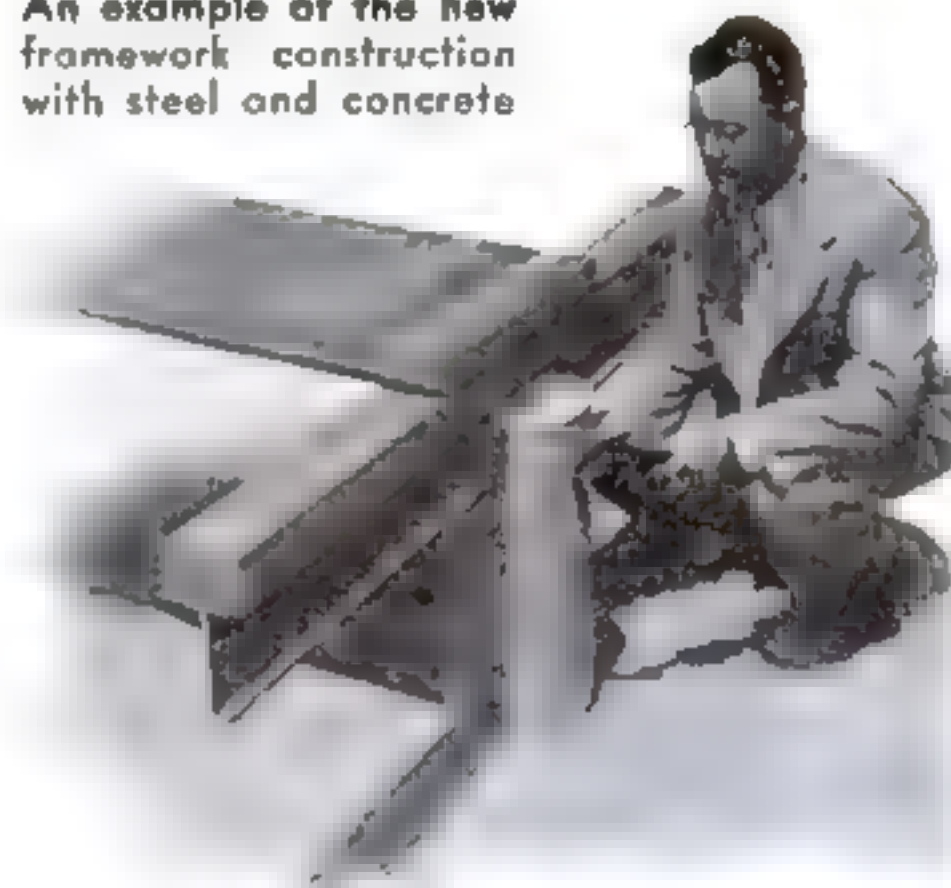
The curbing, useful for garden plots, driveways, tennis courts, and other purposes around the home grounds, is provided in uniform sections that join together to form a neat, durable concrete edging. Both straight and curved sections are available. These are simply laid in place, either on top of the ground, or half buried, then joined with a key-type lock of reinforced concrete. The joints are made permanent by forcing in thin cement with a pump gun. The mortar spreads around projections in the keys, binding the sections firmly together. The prefabricated curbing also can be used for controlling the irrigation around trees and preventing the spread of lawn grass.

The advantages of a steel framework like that used on towering skyscrapers are brought to the small home by a new system that combines the metal with concrete and wood. Concrete pillars are sunk in the ground to serve as a foundation, and steel I-beams fit notches in

their upper ends. Flooring is not attached directly to the beams, but nailed to a wooden stringer that is bolted to each metal girder. The construction is said to avoid the damaging effects of termites and dry rot.

Round-cornered bricks are combined with steel reinforcing bars in a new type of construction for waterproof and fireproof walls demonstrated at the California exhibit. As shown in the photograph, the rounded edges leave space for the insertion of the corrugated steel rods, and for the mortar. The

An example of the new framework construction with steel and concrete



These round-cornered bricks are designed for use with steel reinforcing rods to make fireproof walls



bricks are laid on edge to reduce the thickness of the wall and save material; the steel reinforcing making this practical. Severe fire tests of this kind of construction have shown it to be proof against bulging or breakage under high temperatures. Such walls are suitable not only for houses, but also for garden buildings and garages.

New Steam Boiler Has Dials Like a Radio

CENTRALIZED controls are a feature of a new coal furnace for residential heating. Draft and damper are regulated by knobs like those of a radio, and the dial settings are coordinated to show the positions for maximum efficiency at all times. Projecting parts have been eliminated from the design, making the unit easy to keep clean, while a foot pedal operates the fire door. The furnace also is available for use with fuel oil, or can be fitted with an automatic stoker.



Novel coal furnace and, in circle, foot pedal that opens the door for firing

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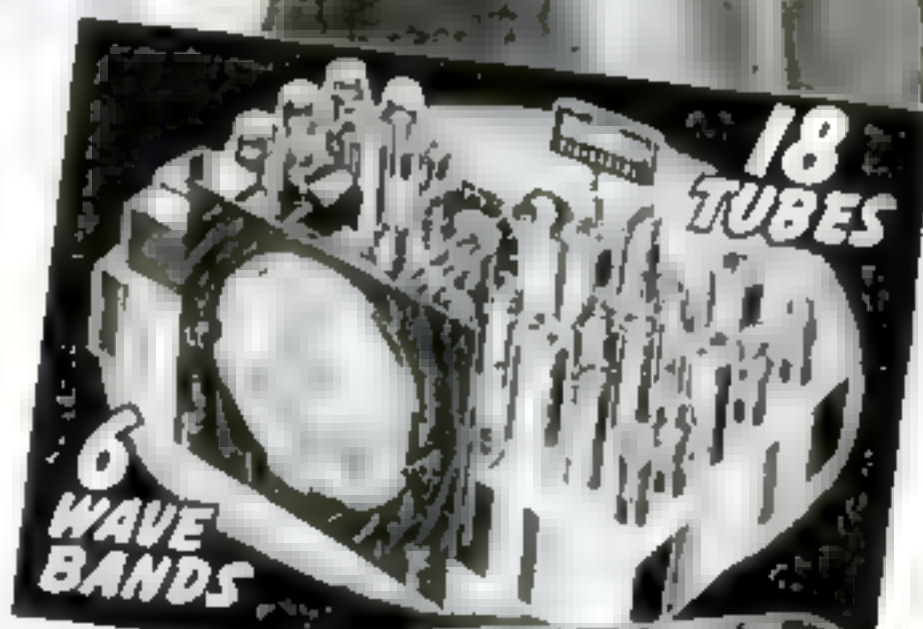
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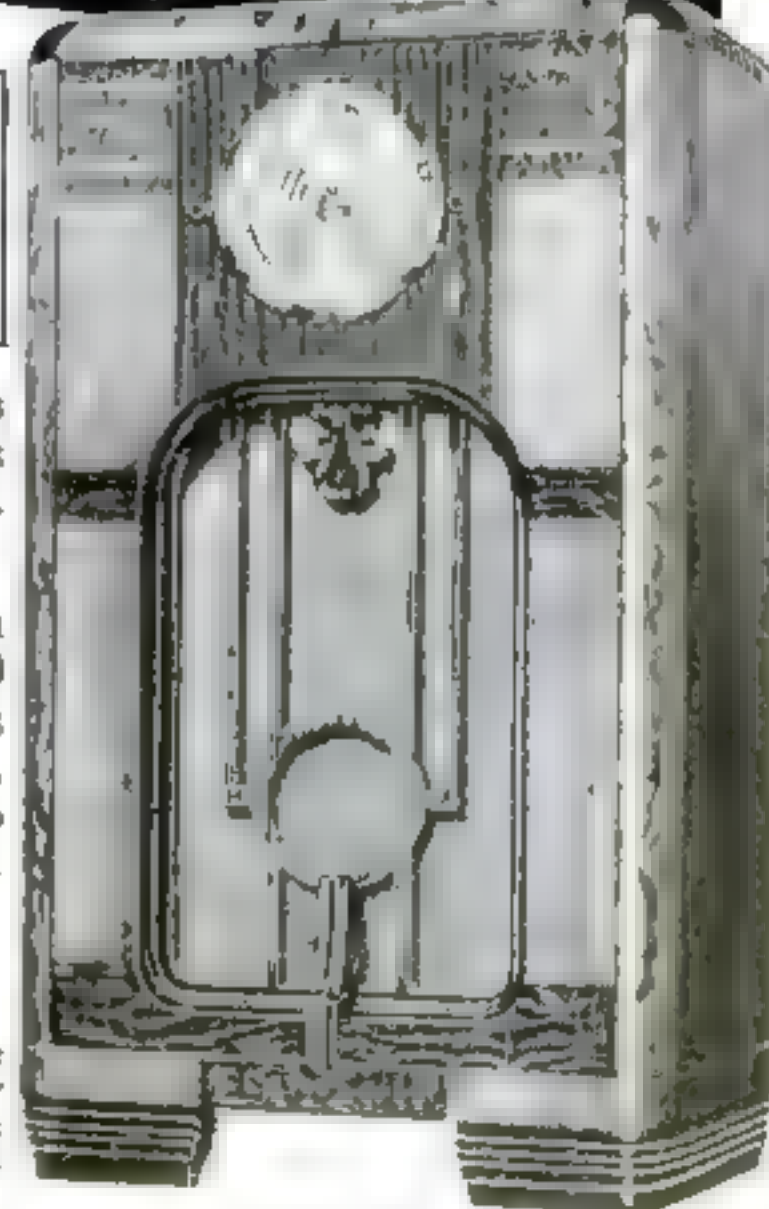
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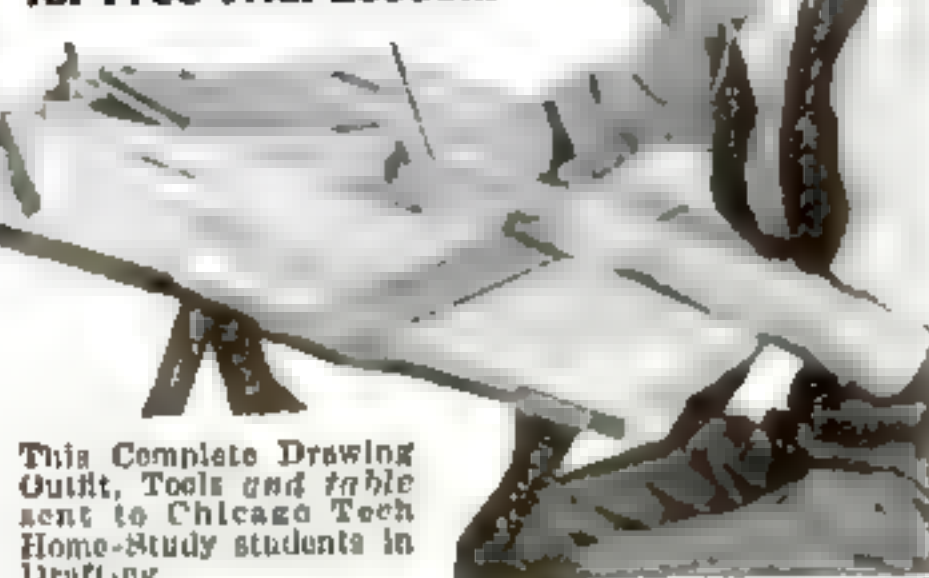
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Plug-in Outdoor Unit Has Waterproof Cover

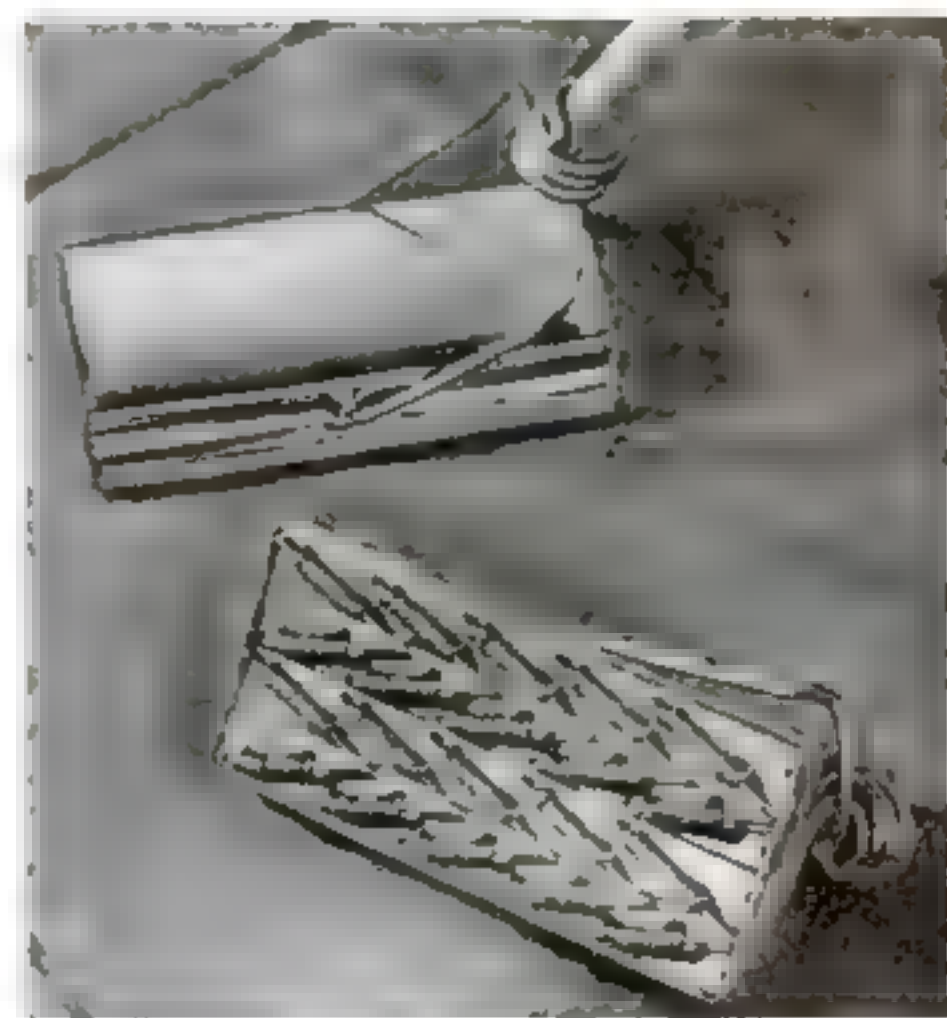


A hood and cover protect wiring from water

ELECTRIC current for use outside the house is supplied by a new type of moisture-tight outlet recently introduced. A weatherproof hood and a spring-operated, hinged cover protect the electrical connections from rain, snow, and ice.

Only one hole need be drilled in the house wall when mounting the unit, which is held in place by two screws, and the job can be completed in a few minutes. A special arrangement at the back locks the entering electric cable firmly in place. The plug-in unit is useful for operating electric hedge cutters and similar accessories, as well as for using toasters and other appliances at outdoor meals. It also provides a troubleproof outlet for floor lamps on exposed porches.

Handy Floor Scraper Needs No Electricity



Two views of the simple floor scraper. Twenty steel rollers, set at angles on the bottom, cut off the top layer of wood with sharp teeth

HARDWOOD and parquet floors are scraped effectively by a new device that is operated in the same manner as a carpet sweeper. Twenty steel rollers, mounted beneath the unit, are equipped with sharp, spiral teeth. When the machine is pushed along, the angle at which the rollers are set makes them revolve, and the keen edges cut off the top layer of wood, leaving a clean, smooth surface for the new coat of varnish. A stiff wire bracket is formed in a loop at one end to receive the wooden handle. Although easy to handle, the device has sufficient weight to cause the rollers to bite into the surface of the wood, insuring thorough removal of the top layer. The machine is handy for small jobs, where the expense of an elaborate floor sander would not be justified.

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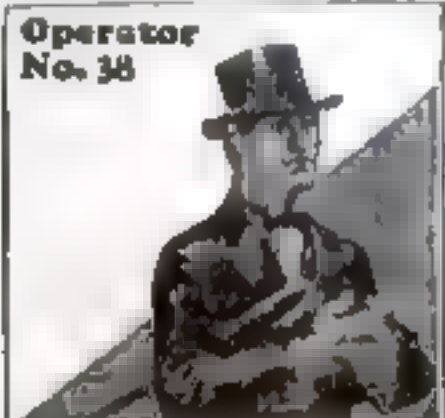
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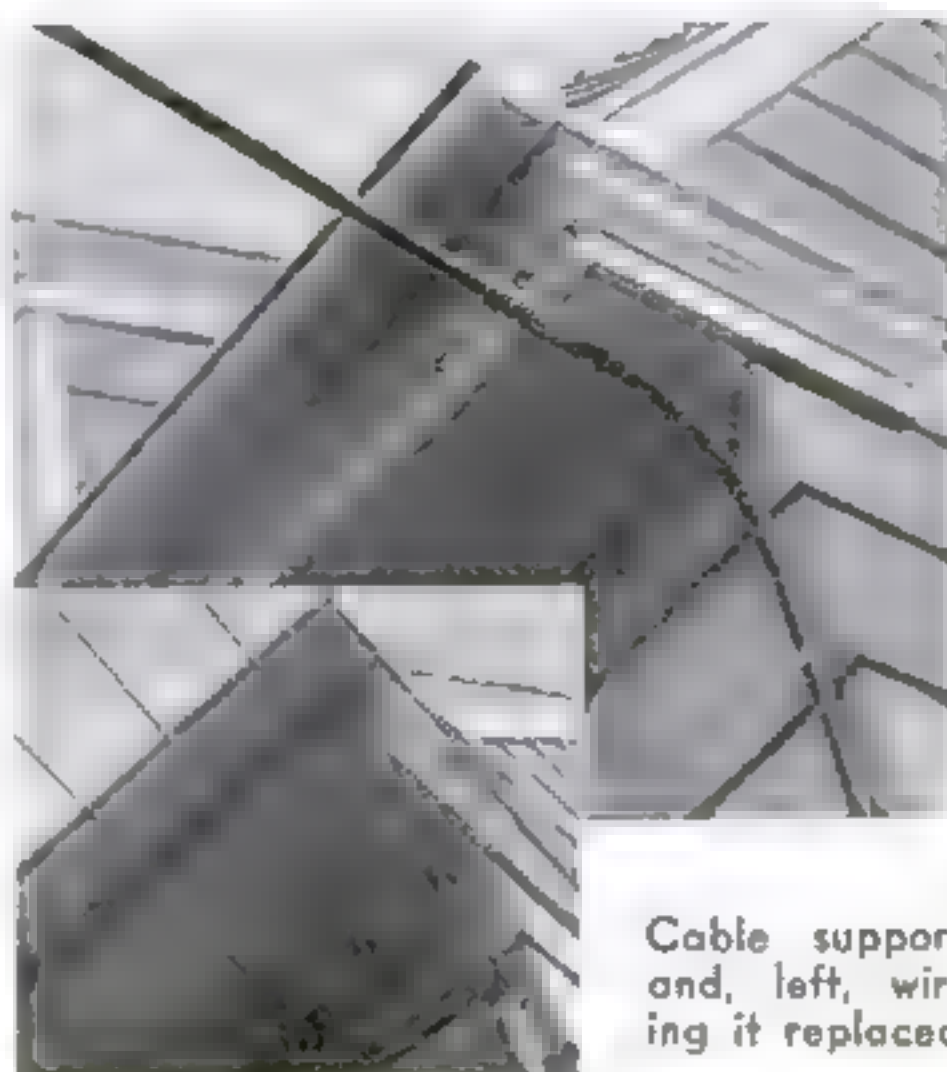
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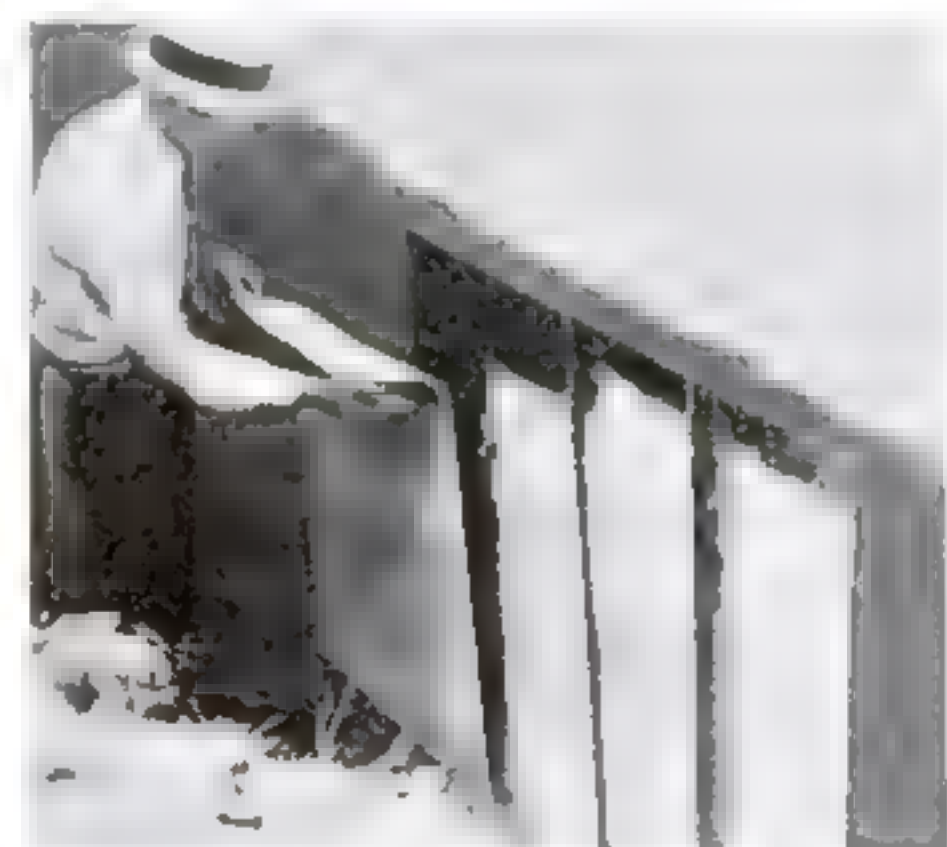
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Steel-Cable Support Grips Electric Wires



Cable support and, left, wiring it replaced

GRIPPING an electric cable with an interlocking mesh of stranded wire, a new support for the power lines that enter a house automatically tightens its hold as the strain increases. Consisting of wires woven into an interlaced cylinder, the new support contracts in proportion to the tension, operating in the same manner as the common Chinese finger-ring puzzles. As shown in the photograph above, the unit replaces the large strain insulators commonly used. Its flexible construction compensates for expansion and contraction caused by temperature changes, keeping the cable tight at all times, and the new-style wiring gives a much neater appearance than the ordinary method.



Laid in hot asphalt and tar, these thin copper sheets will prevent seepage of moisture

Cellars Waterproofed By Thin Copper Sheets

THIN copper sheeting now is available in a form especially suited for use in waterproofing the foundation walls of small homes. The flexible metal sheets are laid in hot asphalt or tar, with the ends overlapping, shingle fashion, as shown in the illustration. They provide an effective barrier to the seepage of moisture through the wall, and the natural corrosion-resisting qualities of the copper insure that the installation will stand up under the varying conditions of dampness and temperature.

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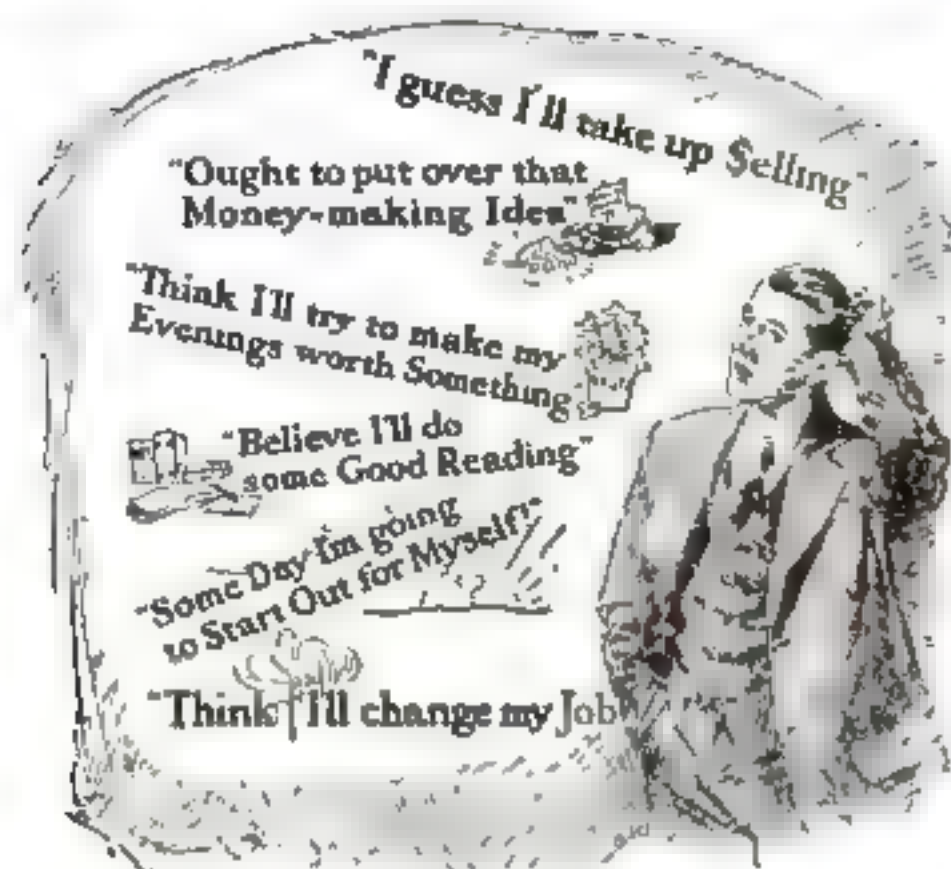
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Questions FROM HOME OWNERS

Q.—IS THERE any way of preventing the drawers of dressers and other furniture from getting stuck in damp weather?—S.U.G., Cleveland, Ohio.

A.—DRAWERS stick in damp weather because the moisture swells the wood. On a dry day take the drawers out and sandpaper the sliding surfaces. Then give the drawers two coats of thin shellac, inside and out. They will slide still more freely if you lubricate the runners with paraffin. Rubbing them with an old candle is sufficient.

Additional Radiators

W.D.C., POUGHKEEPSIE, N.Y. We would not advise you to install an additional radiator in your steam-heating system unless you are certain that the boiler has sufficient capacity to take care of the added unit. If you call a reliable plumber to do the job, he will be glad to make the necessary calculations to see that your present furnace will be adequate for the additional load.

Burned-Out Furnace Grates

M.L.S., ST. PAUL, MINN. Allowing ashes to accumulate until they form a high pile in the ash pit of your furnace probably is the reason why the grates burn out so quickly. Ashes should be removed frequently, and not allowed to heap up under the grate. Another reason for the grate's burning out may be the use of thin, fast fire instead of a deep, slow-burning fire. It also is more economical to keep the fire pot full than to depend on a small, fast fire.

Flower Hygrometers

Q.—I HAVE heard that there is a chemical which can be applied to artificial flowers to make them sensitive to changes in the weather. We plan to place a few of these flower barometers around the house for decorative effect and wonder if you can inform us of the chemical to use.—A.S., Raleigh, N.C.

A.—STAINING the flowers with cobalt chloride will make them turn pink or red when the air is full of moisture, and blue when it is dry. Since the flower reacts to moisture in the air, and not to atmospheric pressure, it is really a floral hygrometer, not a barometer.

Soldering Cast Iron

F.W.C., LANCASTER, PA. Cast iron can be soldered successfully, but not so easily as brass and other metals. First clean the surfaces thoroughly with a file, and apply raw muriatic (hydrochloric) acid. After this has acted for a few minutes, wash it off with water and apply zinc chloride flux made by dissolving zinc in muriatic acid. Use a hot soldering iron to apply the solder, rubbing the (Continued on page 21)



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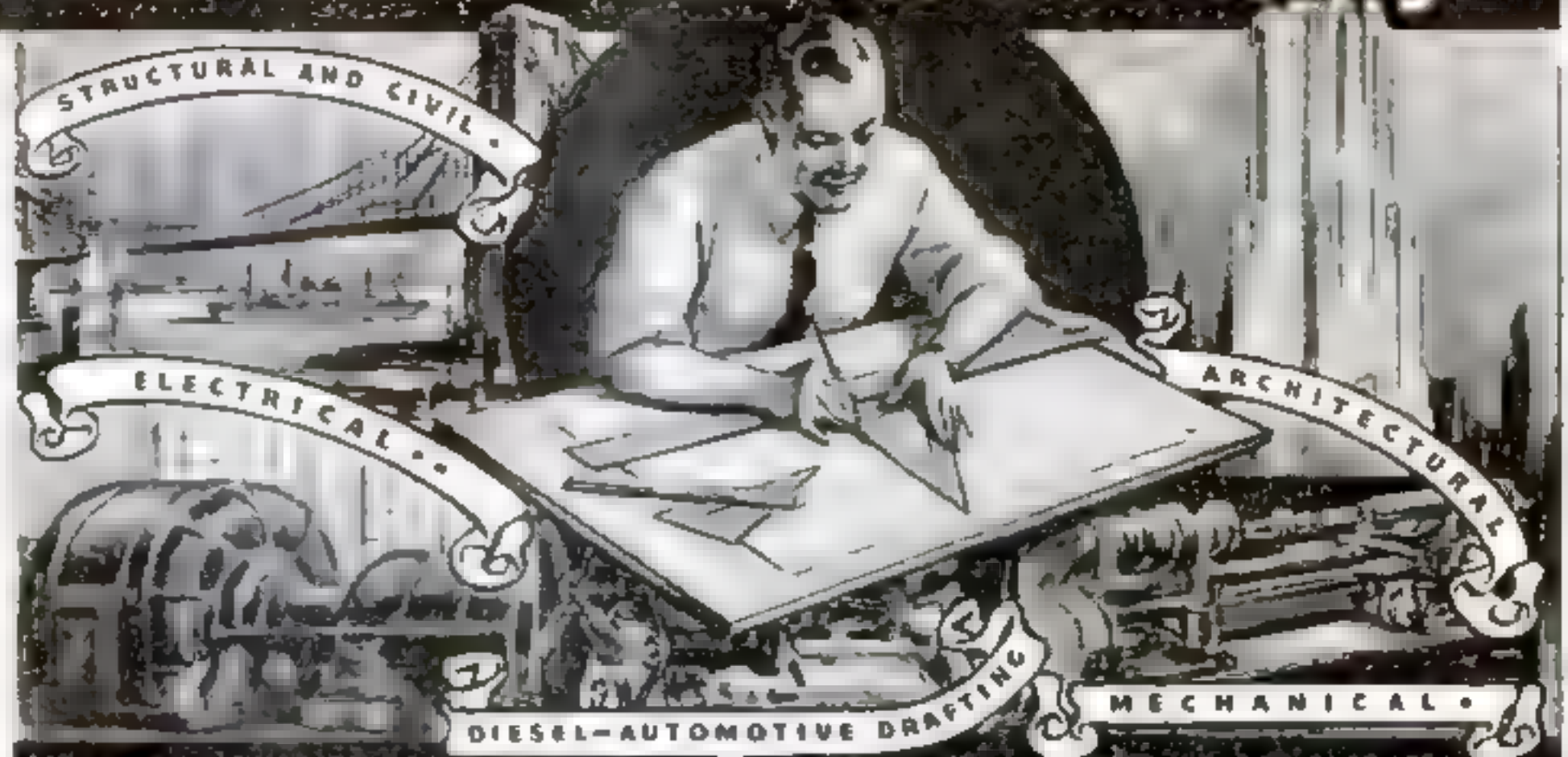
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Questions from Home Owners

(Continued from page 20)

molten metal in well. Be sure to use a large soldering iron, so as to heat up the cast iron sufficiently.

Winter Storage for Screens

N.B.W., AKRON, OHIO. Store screens for the winter in the driest place in your house. A good plan is to fasten a wooden framework to the ceiling beams in the cellar and lay the screens across this. Give them a good coat of screen enamel to prevent rust, and wrap them in heavy paper or canvas.

Patching Broken China

J.P., BROOKLYN, N.Y. Broken pottery and china can be repaired, even if some of the pieces are missing, by the use of a compound that acts as a hardening putty to take the place of lost fragments. Made by mixing plaster of Paris and cellulose cement, the repair material is molded to the shape of the missing piece, inserted in its proper position, and then cemented into place. When the inserted surface is painted or glazed to match the surrounding parts, the patch and its adjoining cracks are visible only with the aid of a magnifying glass, and practically unbreakable after time has hardened the compound sufficiently.

Home Tree Surgery

G.H.McC., ERIE, PA. Filling a cavity in a tree trunk with cement is not a difficult job, but certain precautions must be observed. First, be sure to clean out every trace of decayed wood, to prevent further rotting. If the cavity is of considerable size, it will not do to fill it up with one patch of cement, as the filler will crack under stress. Therefore, divide the cement up into several sections by means of strips of linoleum or similar material. This will give the necessary flexibility. The outside of the patch may be painted to match the tree, if desired, after the cement has dried.

Removing Old Paint

S.T.R., KNOXVILLE, TENN. One of the cheapest and most effective materials for removing large quantities of old paint is trisodium phosphate. This can be purchased at most paint stores, and is also available at grocers in the form of a soapless, sudsless, household cleaner. Dissolve about three-fourths of a cup of the powder in water, and apply boiling hot to the paint with a brush. The paint will soften up so that it can be wiped off. A second application may be necessary.



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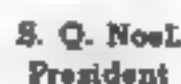
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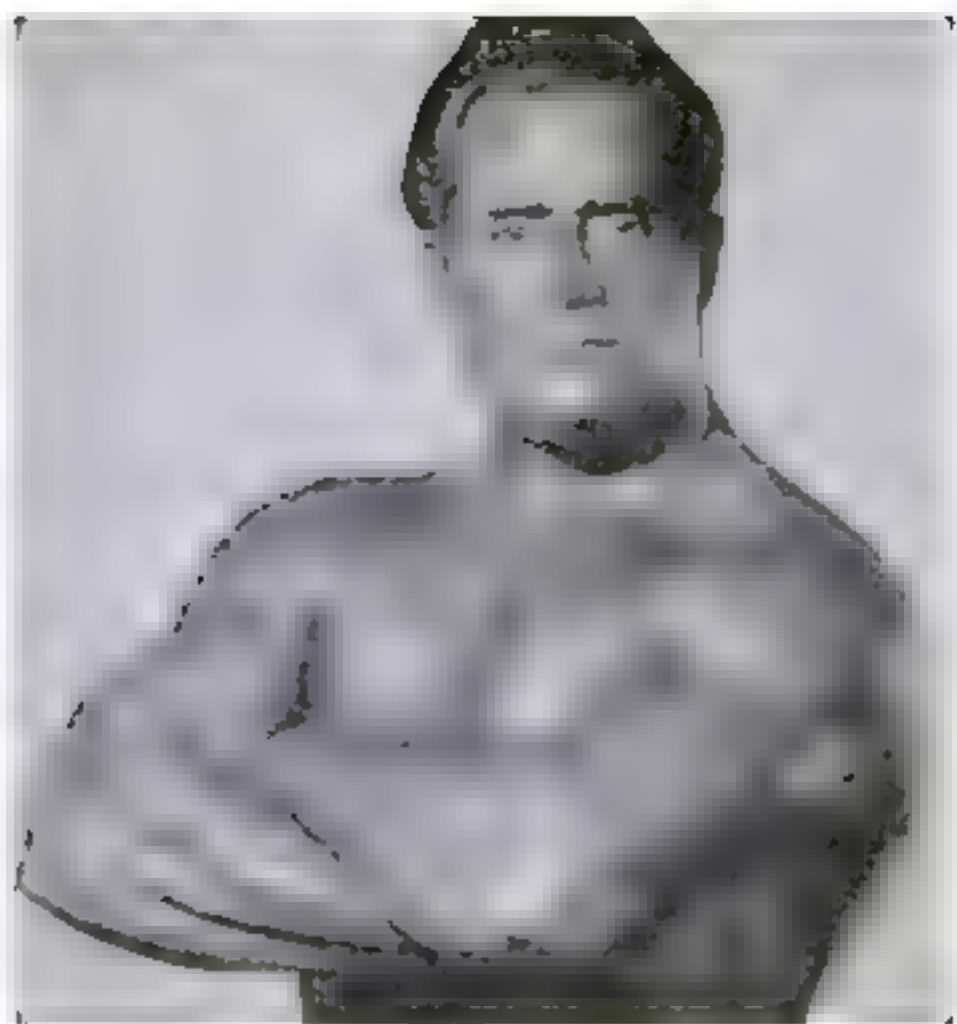
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New Chemical Process Gets T.N.T. from Oil

AMERICAN oil fields could quickly be converted into vast centers for producing war munitions, in case of need, through a recently discovered chemical process for making high-explosive T.N.T. The new method substitutes crude oil for coal, the present raw material. A temperature of more than 500 degrees and a secret catalytic agent, or chemical go-between, are used. The treatment transforms heptane, a derivative of petroleum, into toluene, a chemical that yields T.N.T. when it is combined with nitric and sulphuric acids. According to Dr. Gustave Egloff, noted American oil chemist, the method is capable of producing 150,000,000 pounds of toluene daily from the Texas oil fields alone, and this output would be sufficient to supply the entire world with explosives.

Hundreds of useful substances are extracted from coal and coal tar, but chemists have only recently begun to explore the full possibilities of petroleum. The two or three dozen chemicals produced from it today make up only ten percent of the crude oil. Now research workers are learning to extract others that may create new industries. Recently discovered products obtainable from petroleum include a plastic material for building purposes, edible fats which could be combined with synthetic vitamins and used as food in case of a wartime scarcity, and a chemical for sensitizing plates and films for infra-red or haze-penetrating photography.

Meanwhile a remarkable "chemical calculating machine," developed by E. Bright Wilson, Jr., young Harvard University chemist, is helping to predict in advance the properties of new petroleum derivatives and other chemicals. It consists of an assemblage of rods and spheres, linked by springs, that may be given a variety of motions to imitate the calculated motion of atoms in a particular chemical under spectroscopic examination. By measuring the tension of the springs and the positions of the spheres in the animated model, a mathematically unsolvable problem is answered and an equation is obtained that reveals the chemical behavior to be expected of the substance. Experts expect the new method to prove a great boon to chemical research.

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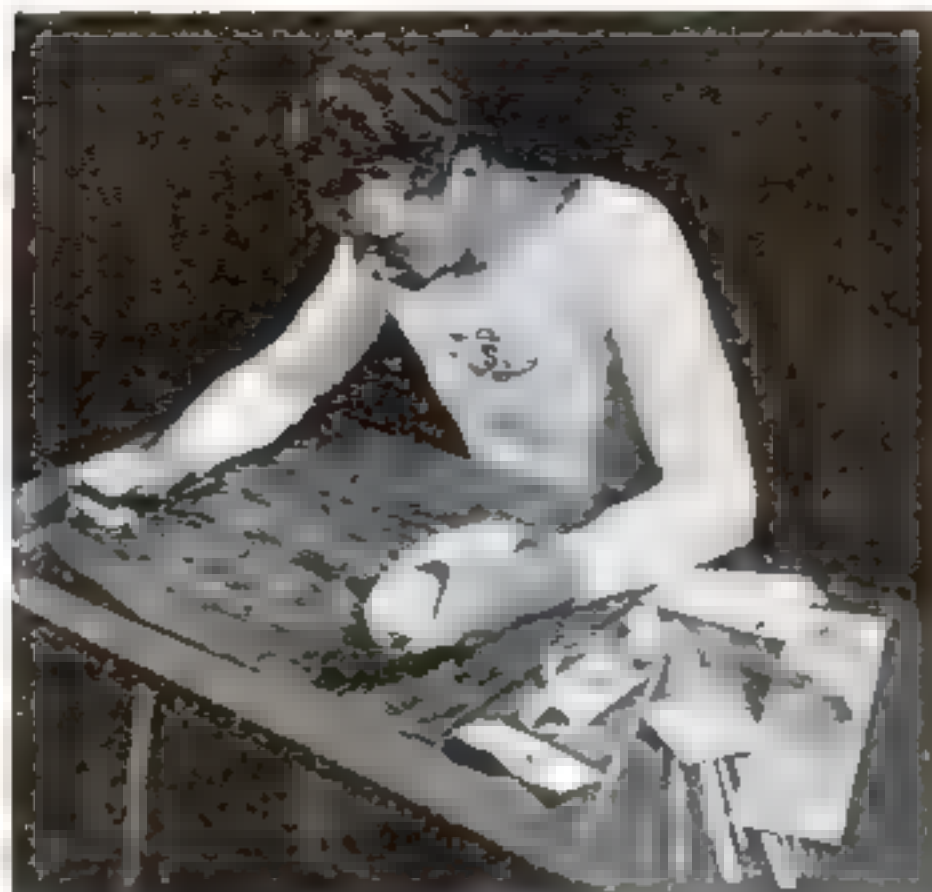
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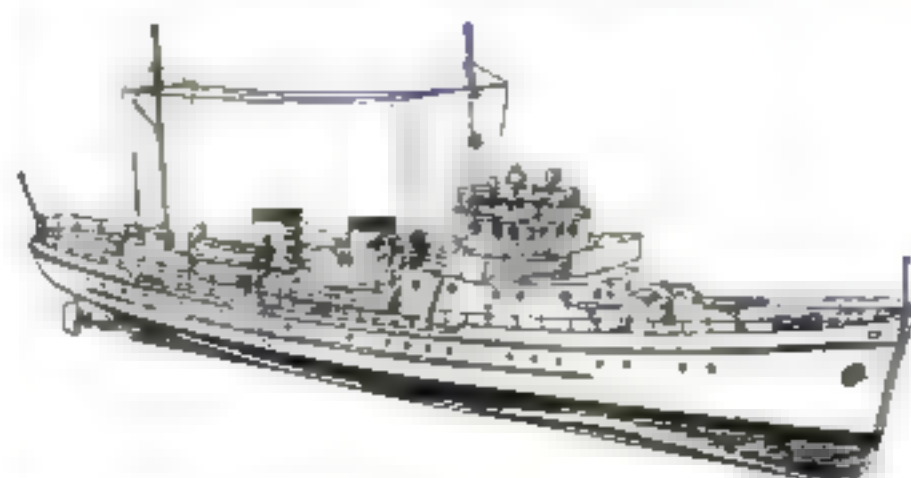
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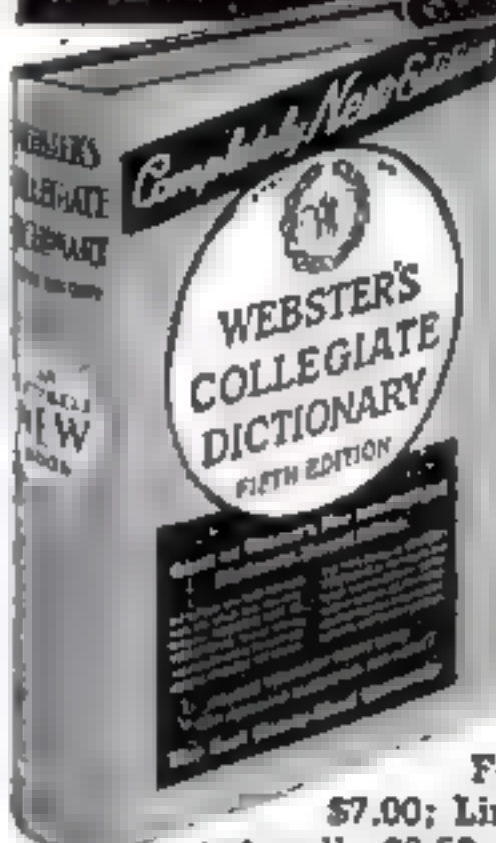
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(Continued on page 25)



Kit 55—A Coast Guard patrol-boat model.

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Build a Ship Model

(Continued from page 24)

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2L. Supplementary power unit for above locomotive. Consists of specially built electric motor (6-v.) and worm and gear.....	4.50

(Continued on page 26)

What Strange Powers Did the Ancients Possess?

EVERY important discovery relating to mind power, sound thinking and cause and effect, as applied to self-advancement, was known centuries ago, before the masses could read and write.

Much has been written about the wise men of old. A popular fallacy has it that their secrets of personal power and successful living were lost to the world. Knowledge of nature's laws, accumulated through the ages, is never lost. At times the great truths possessed by the sages were hidden from unscrupulous men in high places, but never destroyed.

Why Were Their Secrets Closely Guarded?

Only recently, as time is measured; not more than twenty generations ago, less than 1/100th of 1% of the earth's people were thought capable of receiving basic knowledge about the laws of life, for it is an elementary truism that knowledge is power and that power cannot be entrusted to the ignorant and the unworthy.

Wisdom is not readily attainable by the general public; nor recognized when right within reach. The average person absorbs a multitude of details about things, but goes through life without ever knowing where and how to acquire mastery of the fundamentals of the inner mind—that mysterious silent something which "whispers" to you from within.

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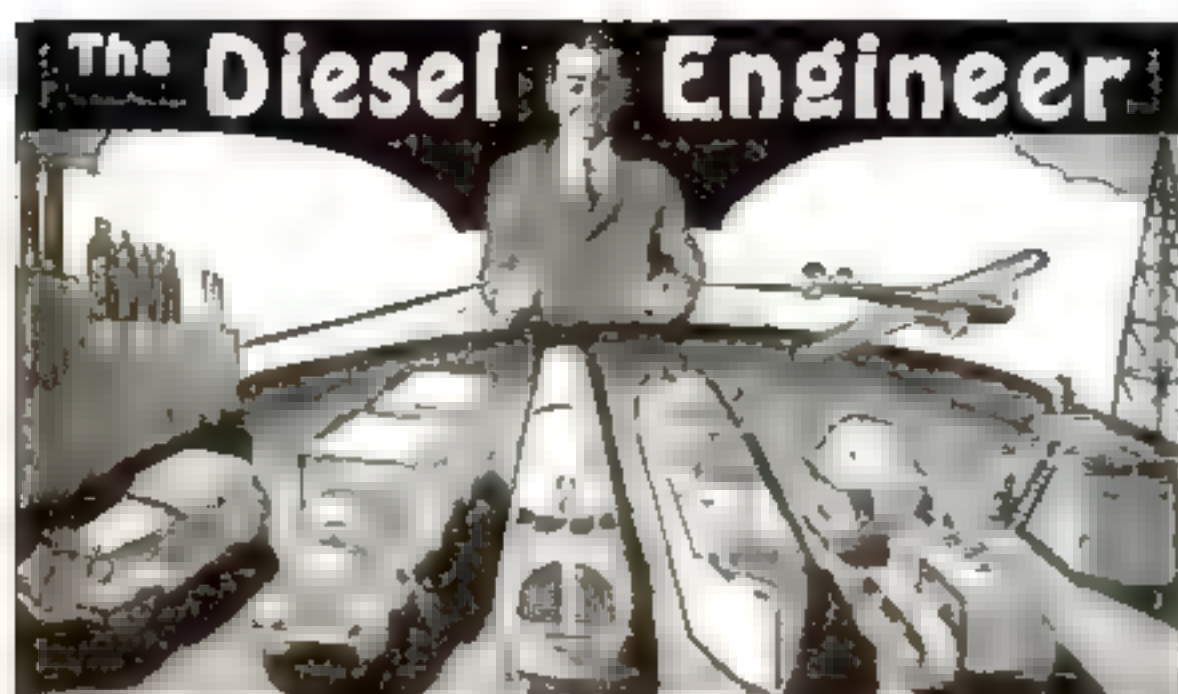
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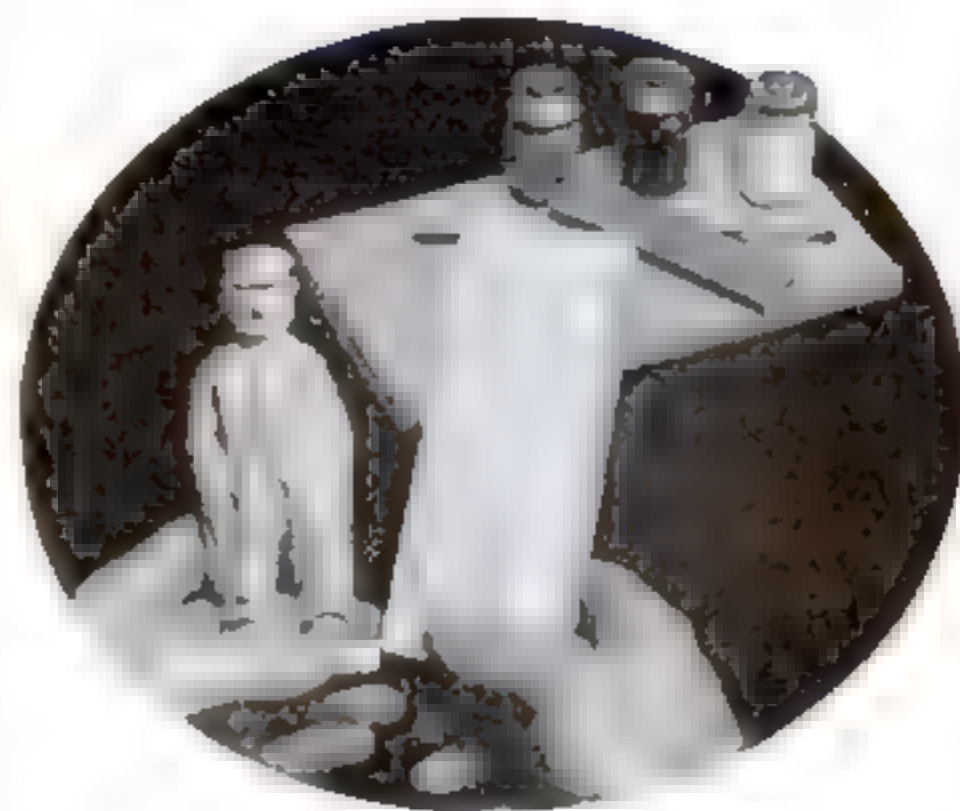
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Build a Ship Model

(Continued from page 25)



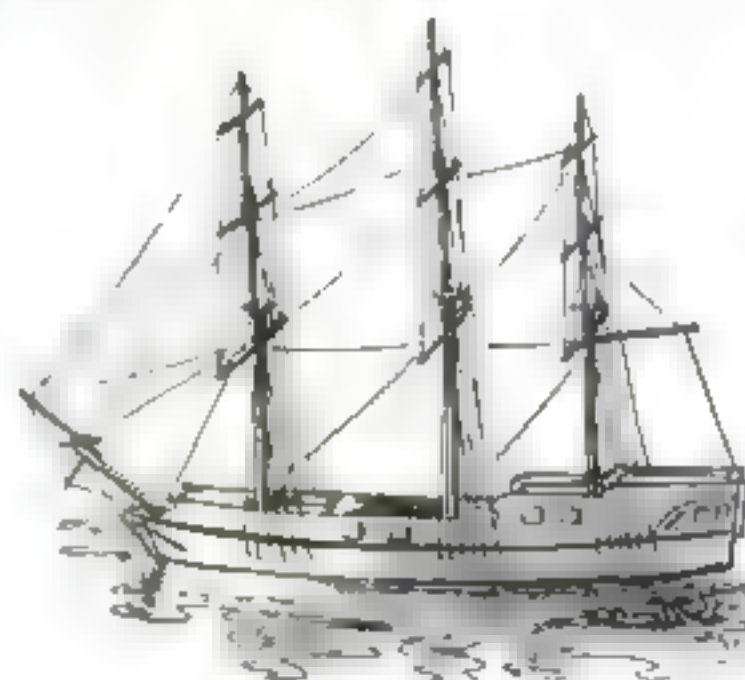
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Kit U—"Hispaniola" of "Treasure Island"

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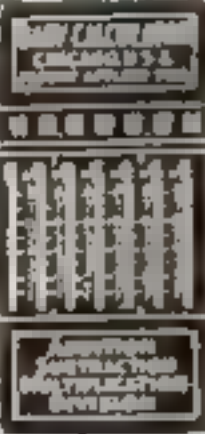


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Tropical Air Lines Fight Yellow Fever

VACCINATION against yellow fever has been ordered for all flying personnel on air lines operating between South America and the United States as part of a program to prevent the introduction of the tropical disease into this country. In addition, all planes coming from South America will be thoroughly fumigated with a special insecticide, made according to a new formula developed by the U. S. Public Health Service. Each passenger embarking on a plane at any South American airport north of thirty degrees south latitude is required to fill out a certificate telling where he has been for the previous six days. From this statement, quarantine officials can learn whether or not the passenger is likely to be infected with yellow fever. If he is less than six days away from a disease area, he may be required to stay under observation long enough to allow any latent infection to develop. These measures are expected to adequately protect the United States from importation of the disease, which is known to exist in seven different countries in South America.

New Propeller Design Reduces Engine Heat

OVERHEATING of airplane engines can be prevented by the use of properly designed propellers, recent wind-tunnel tests show. In a conventional plane, the rush of air caused by the swift passage of the craft through the air is depended upon to cool the engine, but when the airplane operates at low speed, or is taxied on the ground, the air blast is reduced, and the cylinders overheat. The part of a propeller blade near the hub is less effective than that near the tips and is usually rounded, so it does little or no useful work. It is pointed out, however, that if this part of the propeller were made with a proper air-foil section, it would move sufficient air to cool the engine under any conditions.

Fireworks Stimulate Firefly Flashes

DETONATIONS of firecrackers stimulate fireflies to increase the frequency of their flashes, according to a recent discovery by Dr. Rudolf Ruedemann of the New York State Museum at Albany. On a quiet evening, when only about six lightning bugs were visible, giant firecrackers were set off in the vicinity. Instantly, it was reported, the number of firefly flashes increased eight- or ten-fold. When the firework cannonade ceased, the insects promptly stopped their sudden burst of activity. No definite cause of the phenomenon has been proved, but Dr. Ruedemann thinks that their normal flashing is a reaction to threatened danger, and that the sudden explosions served as an artificial danger stimulus to which they responded.

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New Theory Suggests Universe Is Shrinking

IS THE WORLD becoming a smaller place to live in? To account for recent discoveries at Mt. Wilson Observatory in California, Dr. S. Sambursky, physicist at Hebrew University, Jerusalem, proposes the startling theory that the universe and everything in it is slowly shrinking, including even our fundamental standards of length and energy.

Just the opposite view was held a few years ago. When astronomers observed a puzzling reddish tinge in light from distant nebulae, they interpreted the phenomenon as evidence that these celestial bodies were rushing away from us and outward into space as fast as 25,000 miles a second—in other words, that the universe was expanding at explosive speed. The result would be to increase the apparent wave length of light from the retreating nebulae, shifting their color toward the red end of the spectrum or rainbow of hues by which scientific observers classify light rays.

More recently, it has been discovered that the "red shift" actually observed through the big Mt. Wilson telescope does not quite correspond with the amount called for by such a theory. Astronomers have been casting about for a new one, which Dr. Sambursky now supplies. A "red shift" could also be produced, he points out, if everything between us and the nebulae was gradually getting smaller. Substituting mathematical factors based upon his shrinking-universe hypothesis in the same calculations used to test the expanding-universe idea, he obtains figures that appear to check with the observed facts.

As startling to physicists as the Einstein theories of relativity, the new conception implies that their basic units are constantly diminishing in size instead of remaining constant. One of the shrinking quantities is the length of the radius of an electron, smallest particle of matter. Another is "H," a unit of energy upon which measurements of photo-electric cells, among other things, are based. The shrinking value of "H" also provides Dr. Sambursky with a new mathematical explanation for the familiar but little-understood phenomenon of gravity.

While the changes in the "measuring rods" of physics are too small to have a direct bearing on anyone's daily life, Dr. Sambursky maintains that they are nevertheless appreciable enough to be detected in the course of time. To prove or disprove his theory, he proposes measuring the present value of the wave length of a ray of light and repeating the test 350 years from now. Red light from a chemical element called cadmium, which can be measured in the laboratory with great accuracy, would be suitable. At the end of three and a half centuries, if the new theory is correct, the wave length of the red cadmium light should be found to have decreased in length by approximately one twenty-five-thousandth of an inch.

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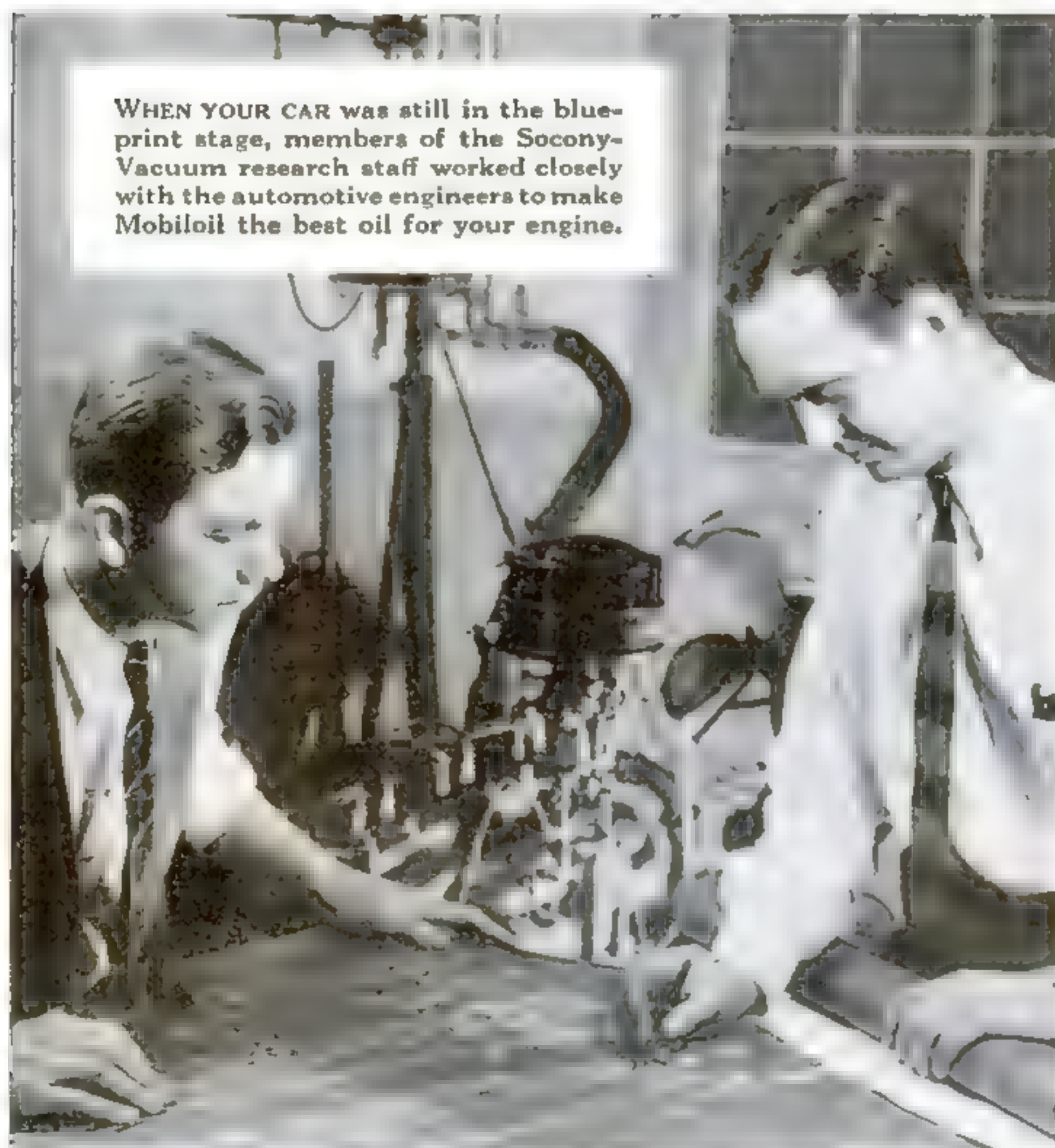
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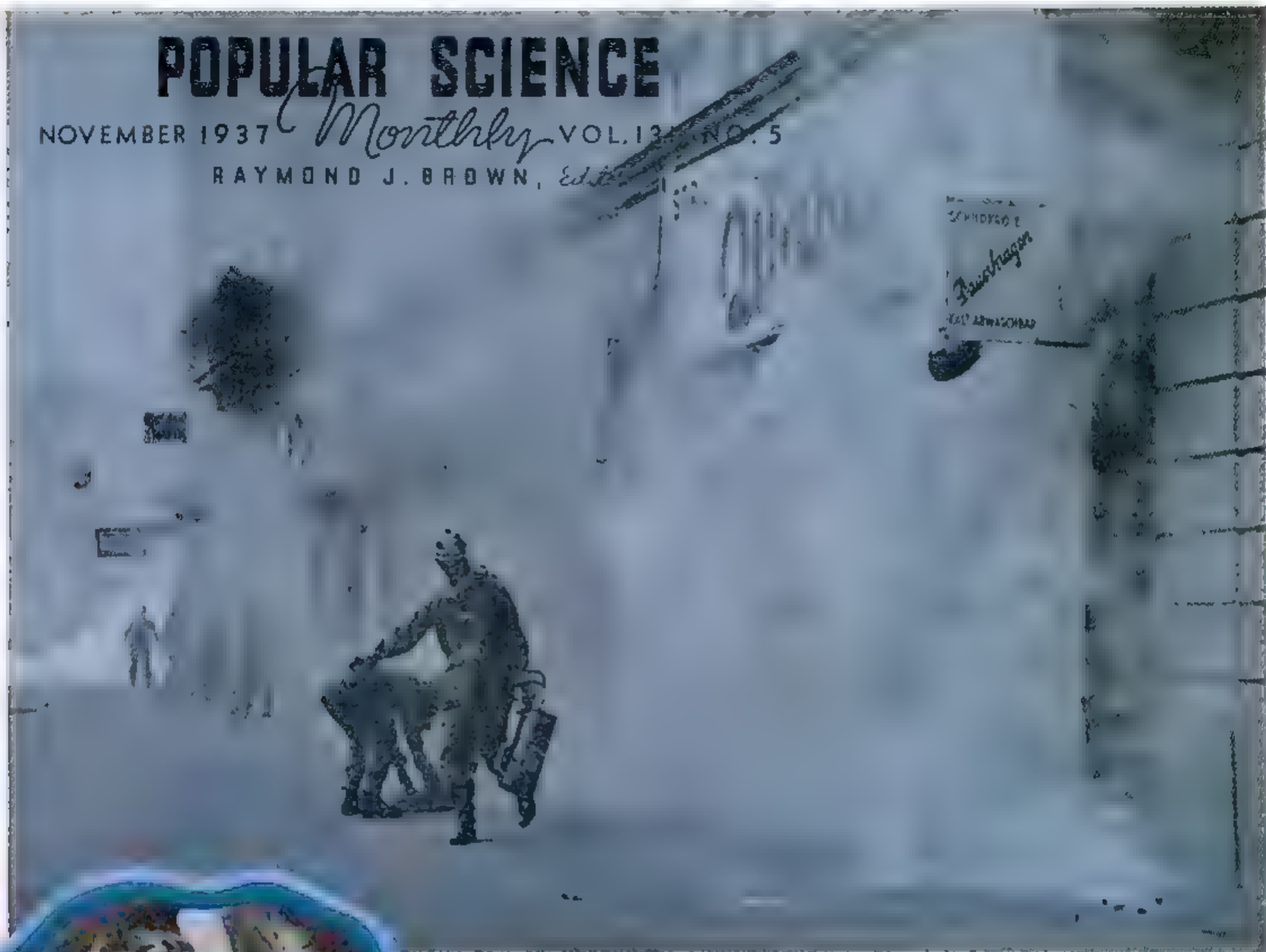
POPULAR SCIENCE

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RAYMOND J. BROWN, Editor



Firemen patrolling the streets of Vienna during a sham aerial gas attack on the city

THE TRUTH ABOUT Poison Gas

By ALDEN P. ARMAGNAC

FRANCE sells gas masks to its citizens on a five-year installment plan. Germany reveals that it has secretly been manufacturing a new type of gas mask for noncombatants, by the million. Startled Britons learn that the world's first factory for civilian masks, at Blackburn, England, has passed its 9,000,000 mark and is turning out 100,000 a day to reach its quota of a gas mask for every man, woman, and child in the British Isles.

Few doubt that poison gas will play a major role in the dreaded "next world war." What will hap-

pen then? Will whole cities, teeming populations, be wiped out in an instant by noxious fumes? Are nations secretly guarding poison gases more horrible than we have ever known? At the outbreak of a world war, will chemists leap to their test tubes and create terrible new poisons to order?

How far such nightmare stories depart from fact has just been revealed by Lieut. Col. A. M. Prentiss of the U. S. Chemical Warfare Service, whose authoritative new book, "Chemicals in War," debunks many of the popular misconceptions about poison gas.

From time to time we hear rumors of

DEADLY ON BATTLEFIELDS, IT IS NOT TO BE FEARED BY CIVILIANS

In future wars, trained men, outfitted in special clothing, will quickly rid city streets of poisonous fumes and liquids after an air raid

Civilian preparedness has gone a long way toward removing the horrors of gas warfare on noncombatants. Below, an emergency crew goes to the aid of a civilian "overcome" during a recent French demonstration of gas-defense tactics



a "supergas," a few hundred pounds of which, dropped from the air, would wipe out the entire population of a city like New York. This country or that is supposed to have discovered it, and to be keeping it in hiding for the next war. Military chemists of a good many nations would like to know of such a gas. The plain fact is that it doesn't exist—except in the imagination of sensational writers.

While two or three new gases have been developed since the World War, none that we know about is startlingly more dangerous than the chemicals used in that conflict. And the mathematical odds are all against the possibility that any nation has secretly discovered such a gas, or will do so in the immediate future.

During the World War, chemists tested more than 3,000 likely chemical compounds and eliminated all but thirty-eight as possible war gases. When these were tried out in battle, not more than half a dozen proved useful for military purposes.

There is a simple reason why additional deadly or disabling war gases are so rare and hard to find. To be a real menace on the battlefield, a gas must be more than poisonous. One of the least effective gases in the World War, for example, was the deadly vapor of hydrocyanic acid. It is one of the most virulent poisons known to man and often is used for the execution of criminals. One or two full breaths cause almost instant death. Fortunately, it has one defect as a war gas. Being lighter than air, it rises harmlessly instead of clinging to the ground and rolling into trenches, dugouts, and city streets.

To be dangerous in wartime use, poison gas must be heavier than air. Raw materials to make it must be readily available. It must be simple to manufacture. It must not spoil in storage. If it is a true gas, it must be capable of being liquefied by moderate pressure in order to be loaded into shells and bombs in concentrated form. If it is a liquid, as some war "gases" are, it must be volatile enough to release clouds of vapor at ordinary temperatures. At least a dozen other requirements could be listed. Discovering a poison gas that combines all these properties is about as easy as finding a left-handed man with blue eyes and a red beard who



Neighborhood stores in many foreign countries sell gas masks to civilians. The group of Swiss women pictured above are purchasing their masks at a drug-store counter

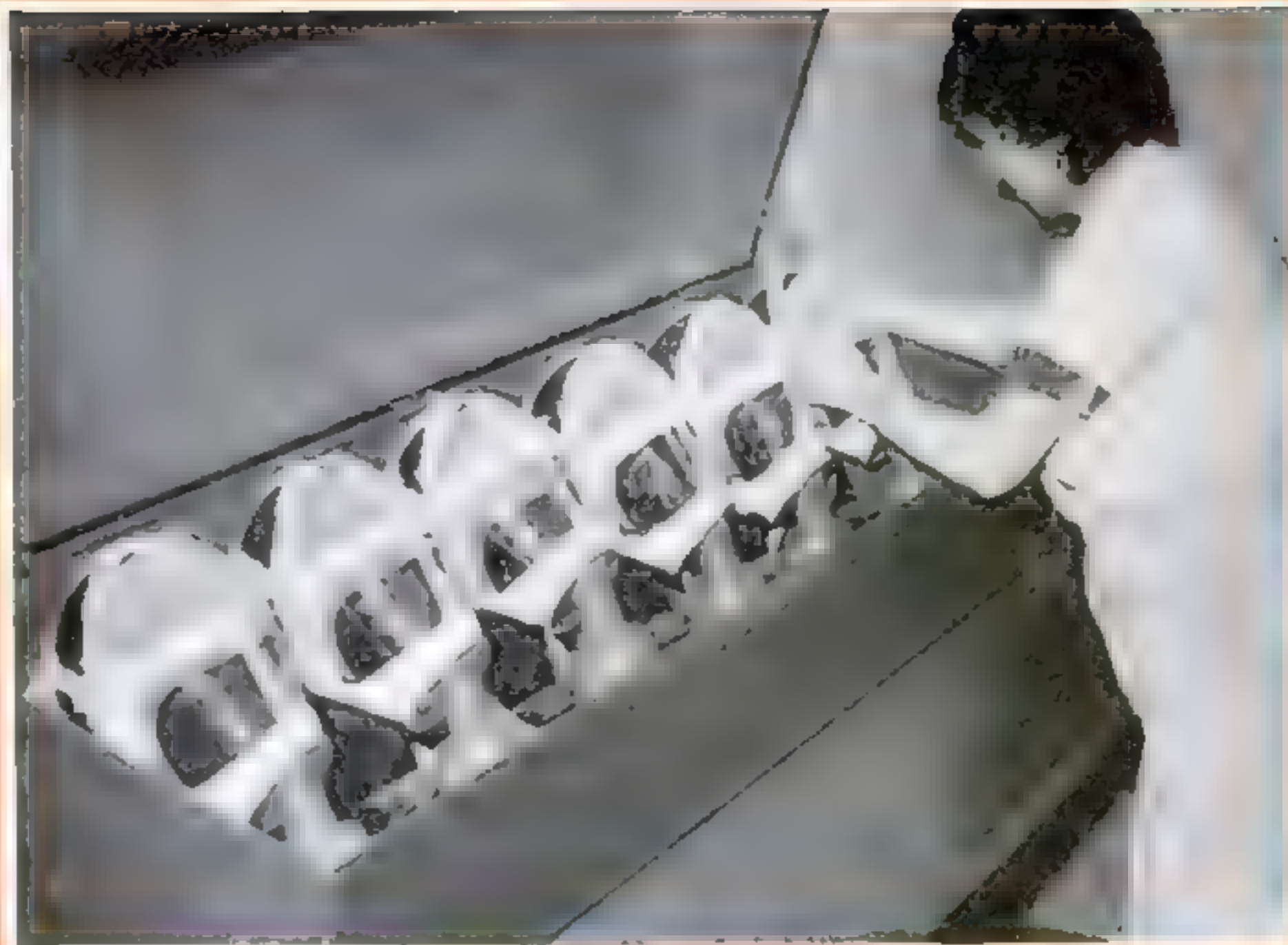
weighs between 180 and 185 pounds, speaks seven languages, and plays the piccolo!

However, where chemists have been unsuccessful in their search for a super-gas, the mechanics of the world's armies have devised new and more horrible ways of using the known poisons.

Aerial gas raids are the latest terror in gas warfare. No World War planes carried gas. Today, aircraft equipped to use it in either of two ways are a part of every important air force. Bombs loaded with chemicals now may be dropped upon a target, exploding and scattering their contents. From tanks beneath the wings, liquid gases may also be sprayed into the air like insecticides, to settle slowly to the ground as a poisonous mist. Italian aviators tried out both methods with deadly effect in their Ethiopian campaign. How much harm they would do against troops of a first-class military power, well trained in gas defense, remains to be seen. Uppermost in the average person's mind, however, is the question of what would happen if they should be unleashed upon the millions of noncombatants of a great city such as New York or London.

But will they be? It has been suggested that certain nations have been deliberately inspiring propaganda exaggerating the likelihood and horrors of aerial gas raids on city dwellers, in order to frighten and bluff other countries and get what they want without actually going to war. There are excellent military reasons, aside from any humanitarian considerations, why a great city is one of the least likely of targets for an aerial gas attack.

First of all, tall buildings make it unsafe for aircraft to fly at an altitude as low as 300 feet, as they must do to spray liquid gases. Planes could drop gas-filled bombs, but many would strike rooftops and release their contents harmlessly. Since war gas clings to the ground, poison-gas bombs are not dangerous unless they reach the streets; and only one bomb out of two would do so, on the average. That may not seem very reassuring, until you realize that the concentration or quantity of poison gas in the air may make all the difference between its being *(Continued on page 137)*



French citizens get five years to pay for masks shown in government testing boxes above

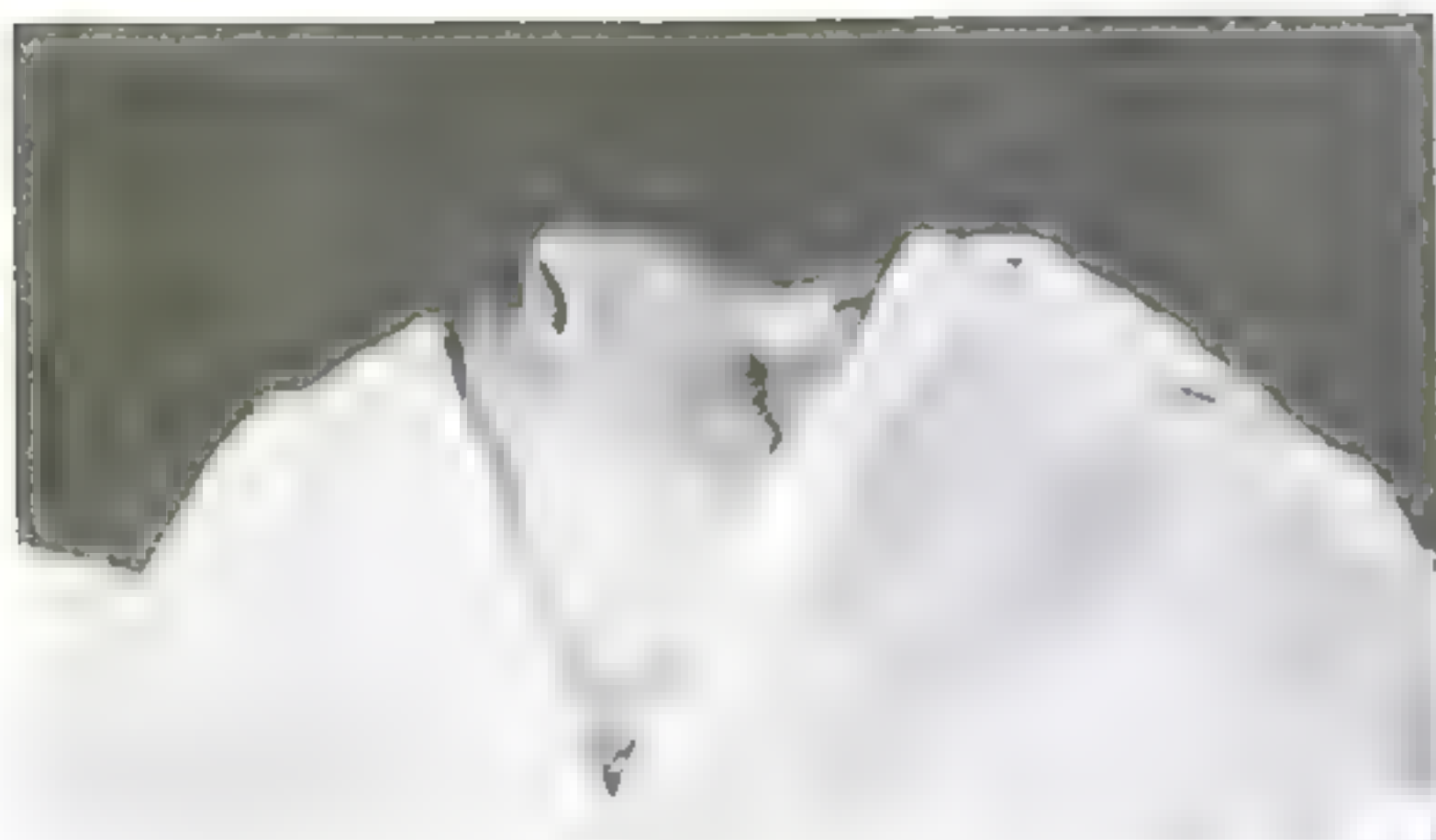


Although aerial gas bombs like these are effective in open country, they would probably have little effect on a large modern metropolis



Experts agree that the work of trained rescue and decontamination crews, like the one at the left, will make a city about the safest place to be during a gas attack

NEW NOSES in 40 minutes



1 At the start of the operation, the patient rests on the table, swathed in towels and gauze. During the actual work, the head covering is pulled down until only the tip of the nose is seen



2 A local anesthetic is injected at various points both inside and outside the nose. This eliminates all pain and leaves the patient conscious throughout the operation. She may even talk



4 To cut off the hump, the operator holds it between the thumb and index finger of his left hand, and cuts through with a sharp instrument. In this delicate work he is guided only by the sense of touch

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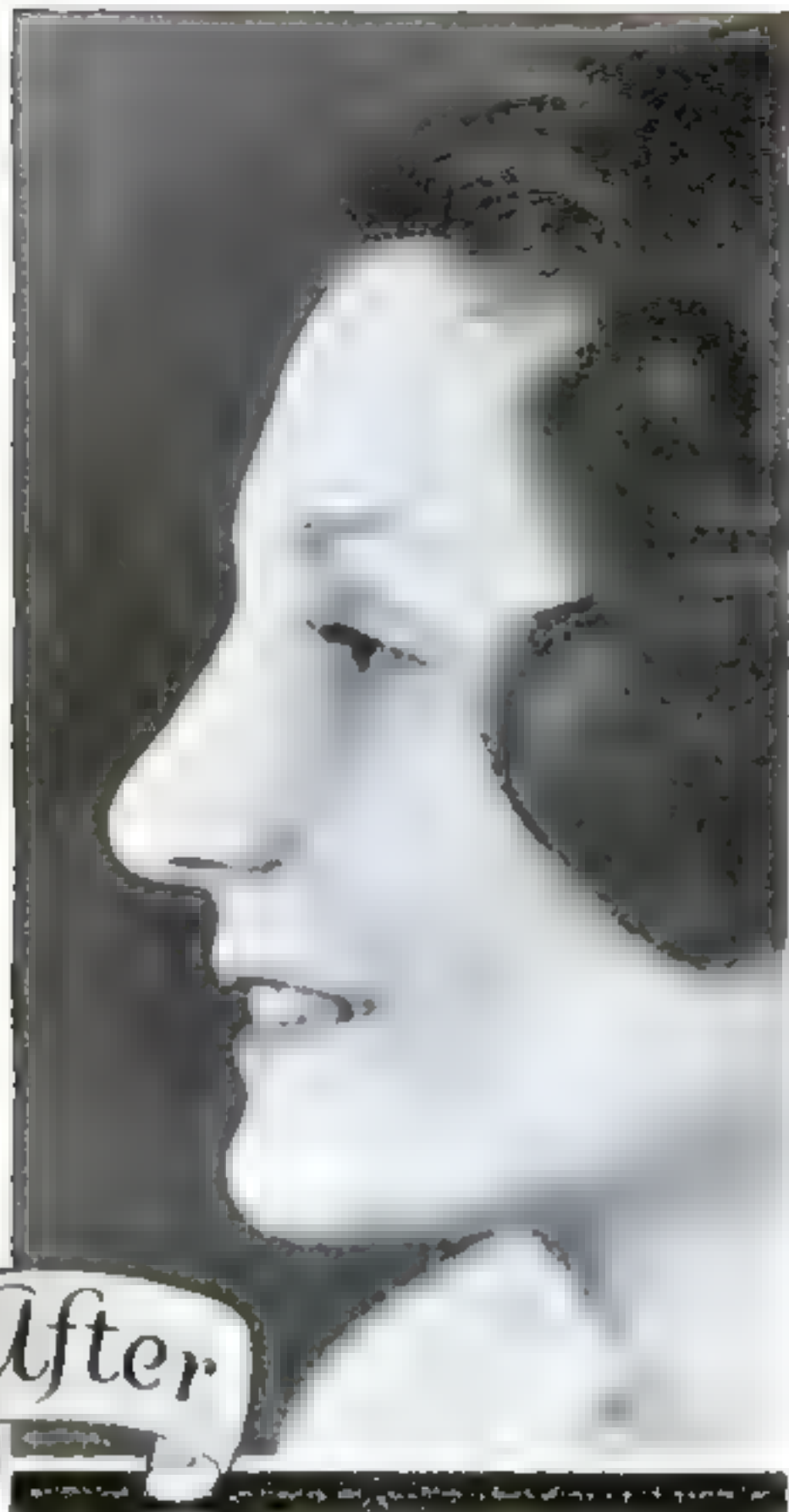
3 The incision is made through the nostril. With the aid of a retractor held in the left hand, the surgeon starts separating the flesh from the bone with a pair of surgical scissors



5 Here the hump is being withdrawn through the nostril by means of a pair of clamps. The piece of bone can be seen extending from the nostril

6 In order that the lower half of the nose may be harmonious with the new shape, a part is cut away and the contour of the tip is changed slightly





IN A forty-minute miracle of modern surgery, an unshapely nose now can be transformed in such a way as to change the owner's face completely. Working entirely through the nostrils in order to leave no unsightly scar, the surgeon's deft hands are guided almost exclusively by the sense of touch as he removes the hump and shortens the nose to normal proportions. Only a

local anesthetic is used and the patient is conscious throughout the delicate operation. The complete transformation of the patient's nose is accomplished in about forty minutes. In the accompanying photographs, a high-speed camera has caught the successive steps of the work in one of the most dramatic series of pictures ever made in an operating room.



7 The next step in the operation is stitching. The parts that have been severed are sewed up

8 Here the saw is being inserted for narrowing the bridge. The teeth of the saw are at the end of the L-shaped instrument



10 With the actual work completed, the next step is to dress the nose. Face coverings are removed and the entire nose is covered with adhesive tape as seen in the photograph above

9 Perhaps the most dramatic part of the operation—the sawing of the bridge. Grasping the handle of the saw, the surgeon exerts all his strength in cutting the bone. When one side of the bridge has been sawed through, the instrument is withdrawn and inserted into the other nostril to saw through on that side



11 Over the tape is placed an adjustable clamp which must be worn for three days to guard the shape of the nose while healing

12 The nose as it appears after all surgical work has been completed. It will not appear normal until all swelling and healing has taken place. Compare this picture with the one at the start

Chair Is Upholstered with Cellulose Film



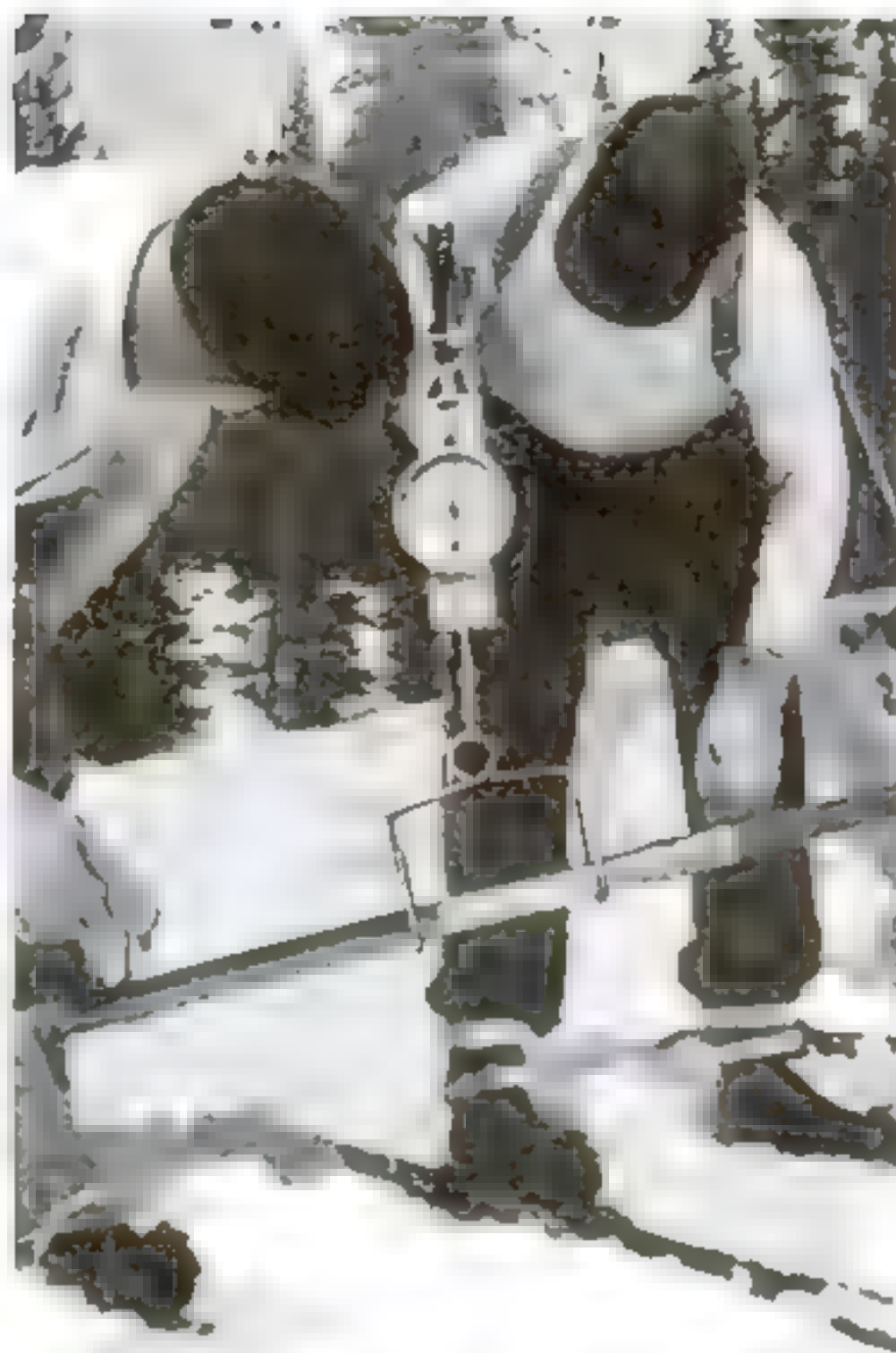
Twisted strands of glasslike material are woven for upholstery

COLORFUL and easy to keep clean, a chair of new German design is upholstered with twisted strands of a waterproof cellulose film. The glasslike luster of the odd material yields a gay decorative pattern when strips woven from contrasting hues are interlaced, as illustrated in the photograph above. Stains and dirt may readily be washed off, leaving the upholstery as clean and fresh as new.



Handy Portable Device Files Piston Rings

USING the light and inexpensive tool shown above, any car owner can make short work of fitting a new piston ring to a cylinder with machine-shop accuracy. Both ends of the ring are filed in a single operation when a handle is turned, producing a continuous six-inch filing stroke. A vertical guide plate holds the ring in the correct position and assures a professional job.



Snow Gaugers Predict Future Water Supply

WILL snow-fed streams and reservoirs be dry or brimming in 1938? Forecasts of the supply of water for sprinkling lawns, for irrigation, for grazing, and for water power will be made available months before the spring thaw through the activities of snow gaugers who measure the previous winter's snowfall. In Yosemite National Park, Calif., annual scene of a typical survey, forest rangers travel on skis to selected snow fields. At fifty-foot intervals they thrust a two-inch tube clear through the snow to the ground. A scale hung from a ski pole weighs the withdrawn tube and the snow it contains, reading directly in equivalent inches of water. Comparing the results with other years' observa-

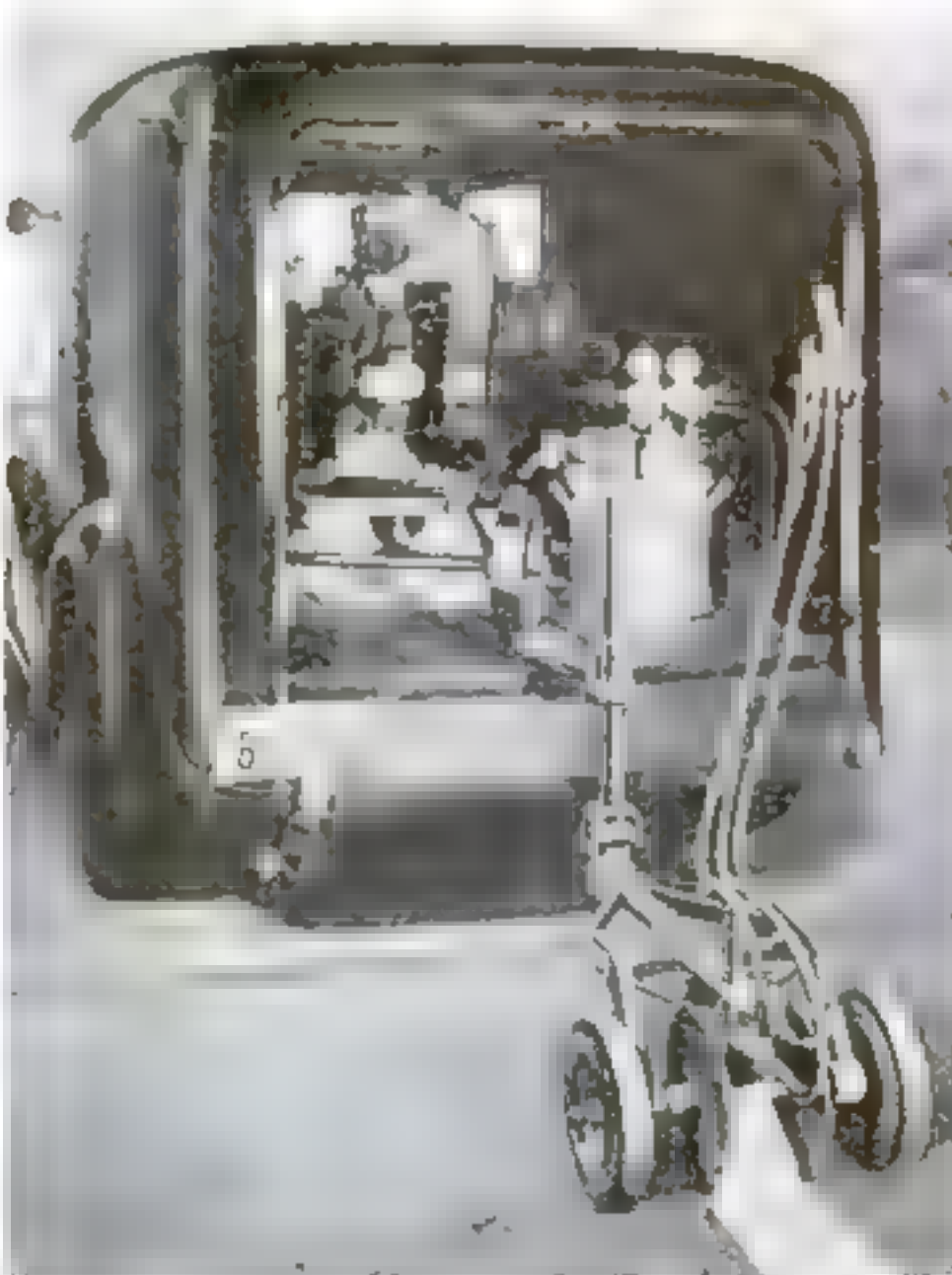


Forest rangers thrusting a hollow tube into the snow and, at left, weighing it to determine how much water spring thaw will yield

The tube is driven down and twisted until there is no doubt it has reached the ground

tions permits water-supply predictions that are accurate within five percent. Their oddest uses include warning rangers of forest-fire hazard, and informing chambers of commerce of the possibilities of advertising wild-flower displays.

Trailing Sprayer Paints Traffic Lines on Road



The sprayer attached to the back of a truck

LINES dividing highway traffic lanes may be painted at the rate of six to eight miles an hour with the aid of a new trailing sprayer attached to the back of a truck. Hand-operated valve controls start and stop a spray of white paint, which is confined to a ribbonlike strip by a pair of disks that are adjustable to make lines varying in width from four to six inches.

Clock Tells Earth's Age

FIXING the earth's age at somewhat less than 3,000,000,000 years, a "clock" of radioactive potassium corroborates the evidence of similar devices using radium, uranium, and other elements that are slowly breaking down, scientists learned recently. The study also fixes the beginning of life on the earth at about 1,500,000,000 years ago. Radioactive potassium gradually changes into the common variety of calcium.

Collecting Snail Shells Is Scientist's Hobby

GATHERING snail shells has provided an unusual spare-time diversion for Dr. Carlos de la Torre, Havana University zoologist and lecturer in American universities. Pursuing his hobby for sixty-three years, the Cuban scientist has acquired one of the world's outstanding collections of its kind, which recently was placed on public exhibition at Washington, D. C.



Dr. Carlos de la Torre with some of his snail shells



Boxers Wear Fireworks in Novel Bout

OUTLINED in flame, two asbestos-clad boxers staged a spectacular bout during a recent pyrotechnic display in London, England. Blazing fireworks, attached to the suits of the two performers on jointed frames to permit them freedom of movement, glowed as they sparred in the dark.

Model Co-operative Town Houses 900 Families

A MODEL suburban community, designed to house 900 families with an average income of \$1,700 in comfortably furnished, Government-built homes, has been established at Greenbelt, Md. No privately operated stores will line the

shopping streets; instead, the town's entire business district will be run on a co-operative basis, and the profits will revert to the residents. The unusual arrangement of the homes can be seen in the photograph below.



Greenbelt, Md., as seen from the air. The model community has no privately operated businesses



Automatic Fountain Serves Soft Drink

AUTOMATICALLY mixing and serving a carbonated drink, a new soda-fountain dispenser is said to blend its product more accurately than could be done by hand. Within five seconds it delivers a paper cup holding the drink as shown above. A built-in cooling unit and a small but efficient carbonator give the beverage the right amount of chill and "fizz." Another model of the machine, operated by dropping a coin in the slot, mixes drinks for self-service patrons and has a capacity of 220 drinks before refilling.

Coil springs under the seat support the unit containing the saddle and sprocket



How the separate riding assembly floats over bumps in the road

New-Style Bike Frame Gives Floating Ride

FLOATING on a separately sprung unit containing the seat and pedal sprocket, the rider of a new-type bicycle negotiates bumps in the road with maximum comfort, according to the claims of the manufacturer. Pivoted to the main frame at the rear hub, the floating assembly absorbs shocks, giving an even, jarless ride. Seat and pedals are the same distance apart at all times. Further cushioning is provided at the handlebar, which is mounted in rubber to permit free flexing.

Folding Vanes Speed Up Wind Charger



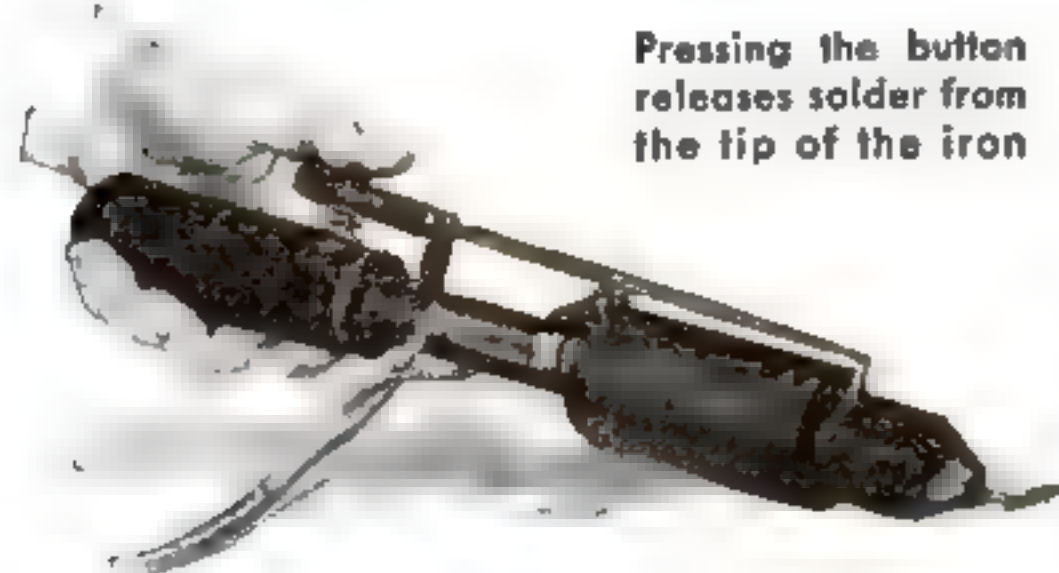
Vanes fold down flat as they swing against the wind

SPRINGS built into the gear housing of a wind charger of new design control folding vanes that comprise the machine's four-bladed propeller, to cut down unnecessary wind resistance by providing a "feathering" action. As they revolve, the blade flaps fold together when full air pressure against them slackens, and then open wide to receive the full force of the breeze at the next revolution.



Odd Cart Displays Posters

A METAL framework erected on a hand cart, and revolved by means of pulleys and belts attached to the cart wheels, serves as a novel advertising device used by a newspaper seller in Birmingham, England. Posters containing news headlines are attached to the frame.



Pressing the button releases solder from the tip of the iron

Soldering Iron Holds Its Own Solder

SUGGESTING a fountain pen, a new electric soldering iron supplies its own solder from a built-in magazine. When a button on the handle is pressed, the metal is fed out through a small hole at the tip of the iron, ready to be melted and applied to the work.

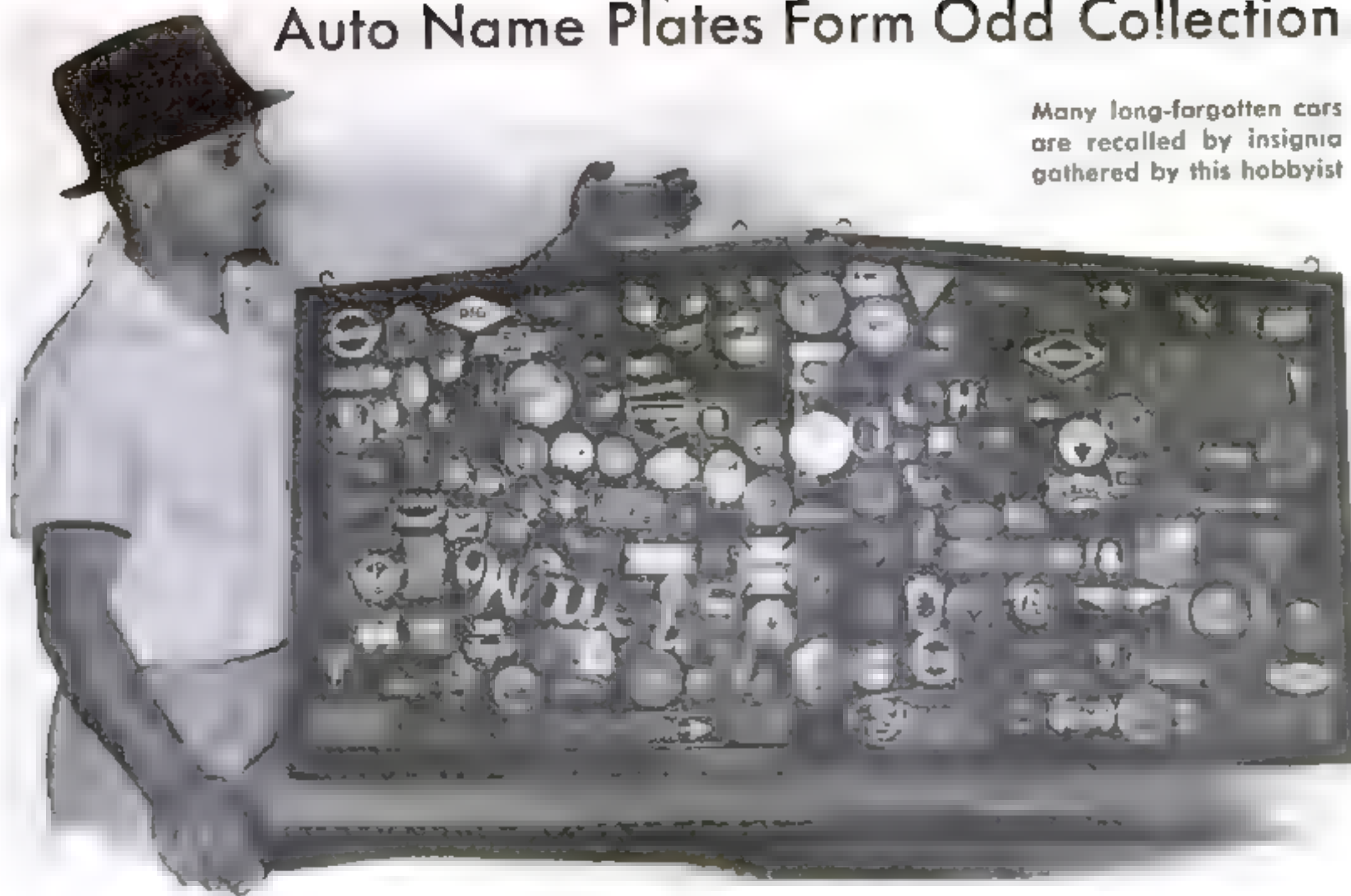
Elastic Cords Save Soap

SOAP attached to an elastic cord and suspended over a bathroom washbowl or kitchen sink is a new household idea just introduced as an economy measure. In use, the soap is pulled down into the water. When released, it snaps back on its cord to its original position, instead of lying in the water and slowly dissolving. Laundry soap placed in knitted bags on elastic cords gives more lather, it is said, because of the friction of the bag fabric, in addition to preventing waste of the soap.



Soap on cords for washbowl use, and in bags for laundry

Auto Name Plates Form Odd Collection



Many long-forgotten cars are recalled by insignia gathered by this hobbyist

COLLECTING automobile name plates is the unusual hobby of Ray Meyers, of Bridgeport, Conn. Included in his collection, illustrated above, are more than 150

different plates, some dating back to the earliest days of the horseless wagon. Meyers combs automobile junkyards in search of additional specimens.

Tourist Cabin Made from Discarded Sailboat

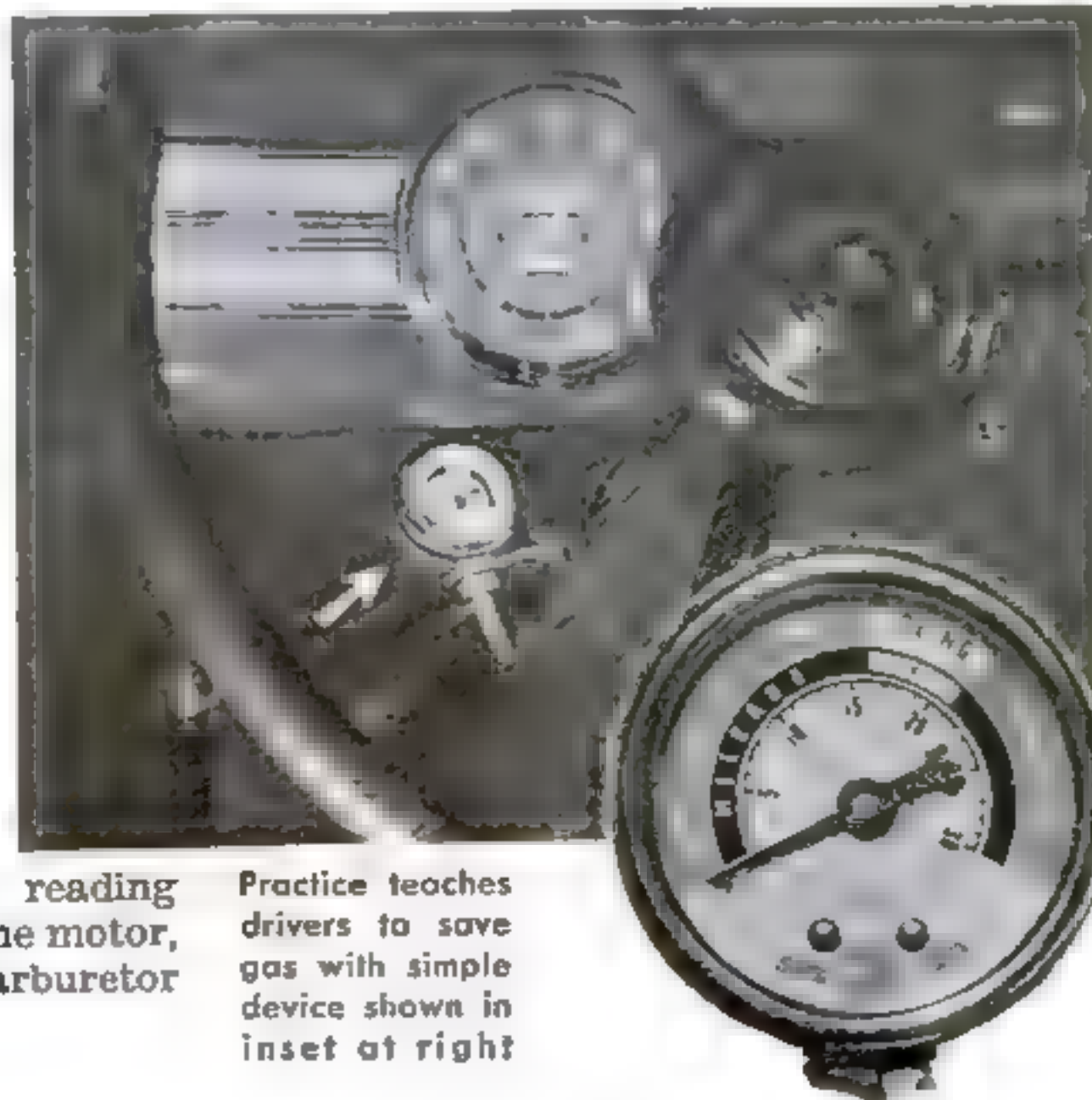


The "sailboat" tourist cabin boasts even a sun deck to attract guests

WHEN A STORM wrecked the hull bottom of his sailboat, Albert O. James, of Lakeport, Mich., hauled it up on shore, scooped out a foundation for it in the sand, and changed it into an overnight cabin for tourists. A wooden shelter was erected over a double bed set into the forward part of the cockpit, while a screened sitting room was built at the aft end and fitted with colorful awnings. The transformation from boat to cottage cost less than five dollars.

New Meter Shows Car's Gas Mileage

MOUNTED on an automobile steering column and connected to the intake manifold, a new meter enables a motorist to keep a constant check on engine performance and gasoline mileage. Essentially a vacuum gauge, the meter has a dial calibrated in units from one to thirty, representing the number of miles to a gallon of gasoline. By operating his car so that the dial indicator registers at the highest point, the motorist can obtain maximum efficiency from the engine. A low reading indicates abnormal conditions in the motor, such as a leaky valve or poor carburetor adjustment.



Practice teaches drivers to save gas with simple device shown in inset at right

Skill is more important than speed when the racers, below, run with baskets on heads



Basket Balancers Hold Novel Race

BALANCING half-bushel baskets on their heads, porters employed in an English food market ran an unusual foot race that was an outstanding feature of a recent athletic meet held in London. The photograph above shows two of the contestants practicing for the event, worth \$100 to the winner.

Sun Not So Bright

COMPARED to other stars in the same class, our sun is a weakling as far as brightness is concerned. According to recent tests at Harvard University, it gives off only seven tenths of the radiation it should for its size.

A scene in the studio of WQXR, New York City, as an inventor demonstrates a folding utility table to the advisory board of manufacturers and merchandising experts. The microphones pick up his description of the device, and the comments of the board members, for radio listeners-in

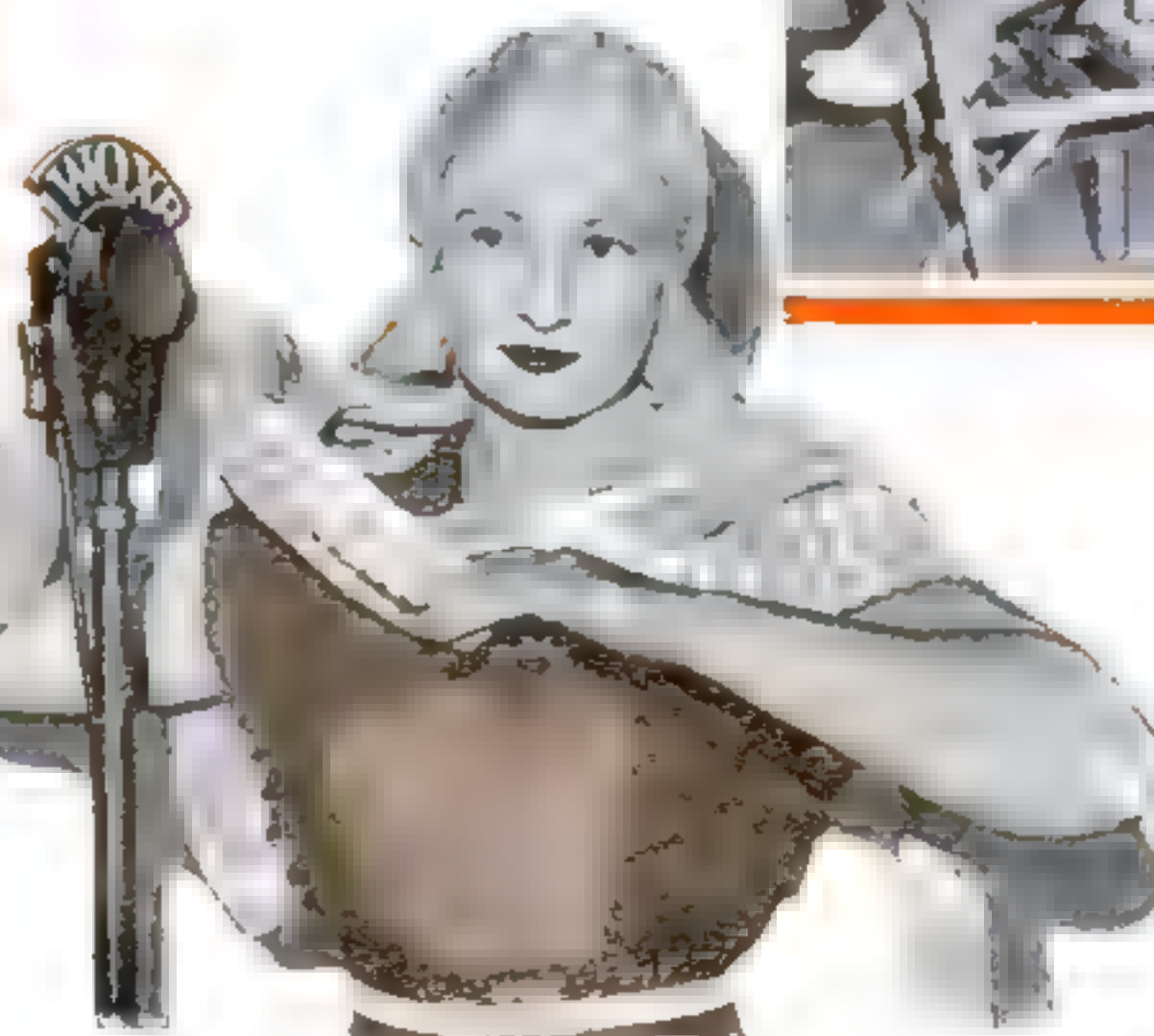


Inventors ON THE AIR



PROTECTING THE INVENTOR. Before any device is described on the air, a recording is made of the inventor's voice explaining the details of its design and use

BROADCASTING A BATH
This young woman is telling the radio audience about a hood and chair that turn any tub into a Turkish bath. The drain extension seen at right keeps hot water at the proper level



KEEPS HAIR NEAT
Pulling a sweater over her head in front of the microphone, the inventor of a "Hollywood helmet" proves that this simple silk headdress enables a woman to change garments without mussing her hair. It also is handy at the beach and in driving

BUDDING EDISONS NOW HAVE A RADIO AMATEUR HOUR ON WHICH TO TELL THE WORLD ABOUT THEIR NEW DEVICES

THROUGH the microphones of broadcasting station WQXR in New York City, amateur inventors describe their new devices to radio listeners in a regular weekly program aptly named "Can It Be Done?"

In addition to placing their ideas before a potentially large audience, they benefit by the criticisms and suggestions of an advisory board of manufacturers, merchandisers, and business executives. A phonograph recording made before the broadcast protects each inventor in his claim to prior conception.

Although comparatively new, the novel radio feature is said to have resulted in the sale of several inventions to manufacturers. Some of the devices presented on the program are shown on these pages.



PICNIC OUTFIT. A chef tells the radio audience about his compact kit for outdoor meals. Table tops with folding legs form the sides of the carrying case, which holds the food, dishes, and even four folding chairs



PLATFORM STEPLADDER. Alice Pentlarge, radio commentator, examining a novel ladder that has folding platforms to give plenty of standing room

BELL FOR ROLLER SKATE. Another innovation presented on the air was the warning bell seen below. It can be attached to any skate



GLOVE PURSE. Listeners were told that money put into this glove pocket is easy to get at when needed. The opening is closed with a slide



HAND SNOWFLOW. Appropriately costumed, this inventor is demonstrating a device with which, he claims, a man or woman can clear a sidewalk or driveway much more easily than with a shovel

EXPLORERS HUNT PREHISTORIC ANIMALS

IN **Lost Worlds**

Photo courtesy of American Museum of Natural History

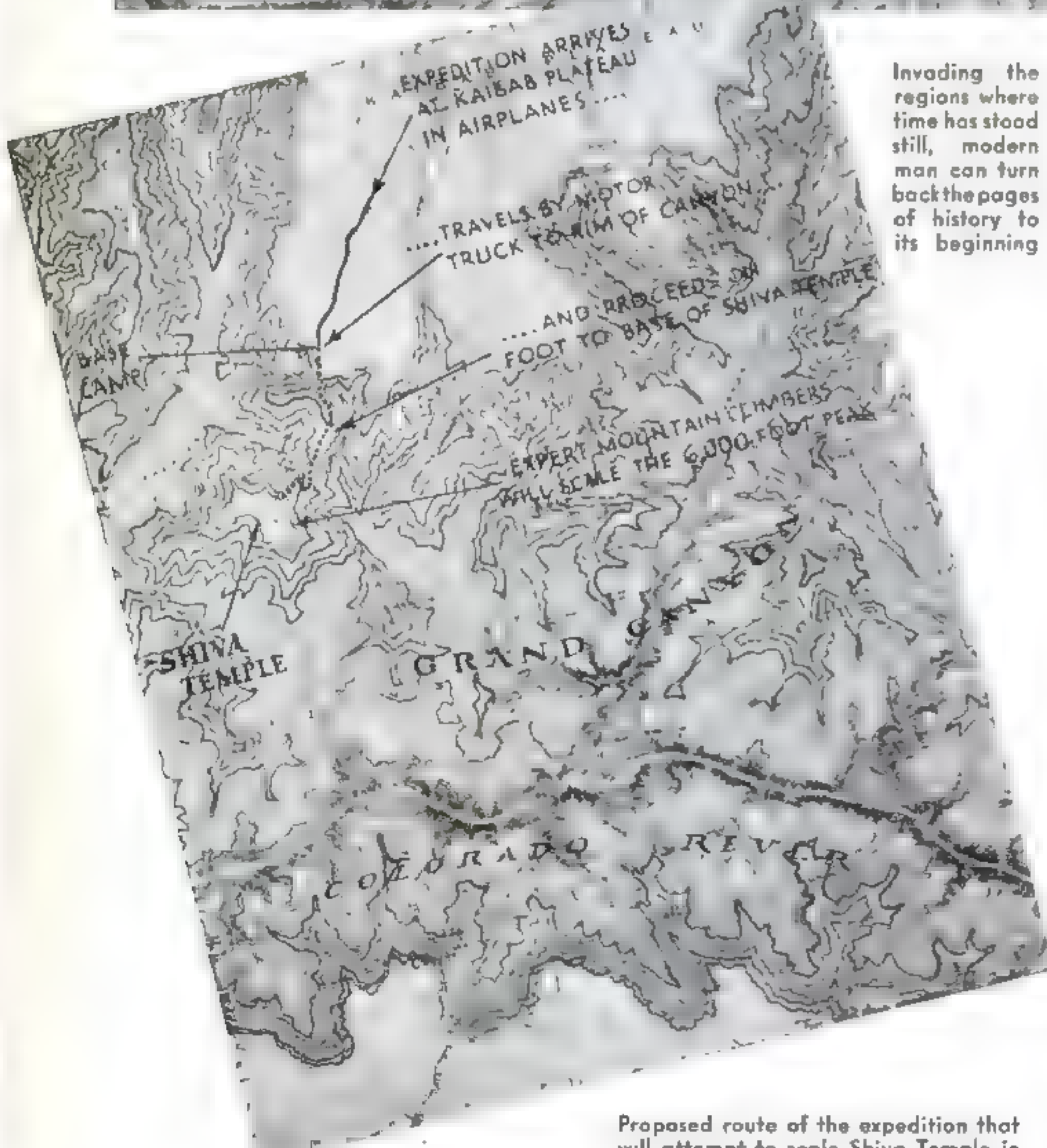
Invading the regions where time has stood still, modern man can turn back the pages of history to its beginning

TWO swift airplanes, as this is written, are speeding across southwestern states toward the Grand Canyon of the Colorado. Riding in the cabins are members of an expedition from the American Museum of Natural History in New York City. They will attempt to scale the precipitous cliffs of Shiva Temple and reach the lost-world plateau at its top, where they hope to find strange prehistoric forms of life which have survived their ages of isolation.

This eminence rears its great bulk, like an island in the air, 8,000 feet above the base of the canyon. For 200,000 years, its square mile of wooded summit has been cut off from the rest of the world. Walter A. Wood, Jr., internationally known mountain climber, will tackle the almost perpendicular cliffs. If he reaches the top, he will lower rope ladders for other members of the party including Dr. Harold E. Anthony, curator of mammals at the museum and leader of the expedition, who will search the square mile of land for strange creatures and rare plants.

One of the recurring dreams of science has been the discovery of some remote bit of land that has remained the same for hundreds of thousands of years and will give us a glimpse of the world as the cave man saw it. The Galapagos Islands with their ancient, gigantic turtles, and Australia with its primitive forms of life found nowhere else, are examples of isolated areas that date far back into the past. Among the mountains of California, scientists have discovered a whole chain of plant "orphanages," small areas that contain old forms of vegetation unknown elsewhere. Other scientists have found "desert sardines" in the springs of Death Valley. These tiny fish, far removed from lakes and streams, are thought to have been left behind when the prehistoric seas which once covered the land receded.

The books of H. Rider Haggard, A. Conan



Proposed route of the expedition that will attempt to scale Shiva Temple in the Grand Canyon and explore the mile-square isolated plateau on its top

In remote corners of the earth, cut off from the rest of the world for countless centuries, scientists are discovering strange creatures that survived from the days of the cave men

By EDWIN TEALE

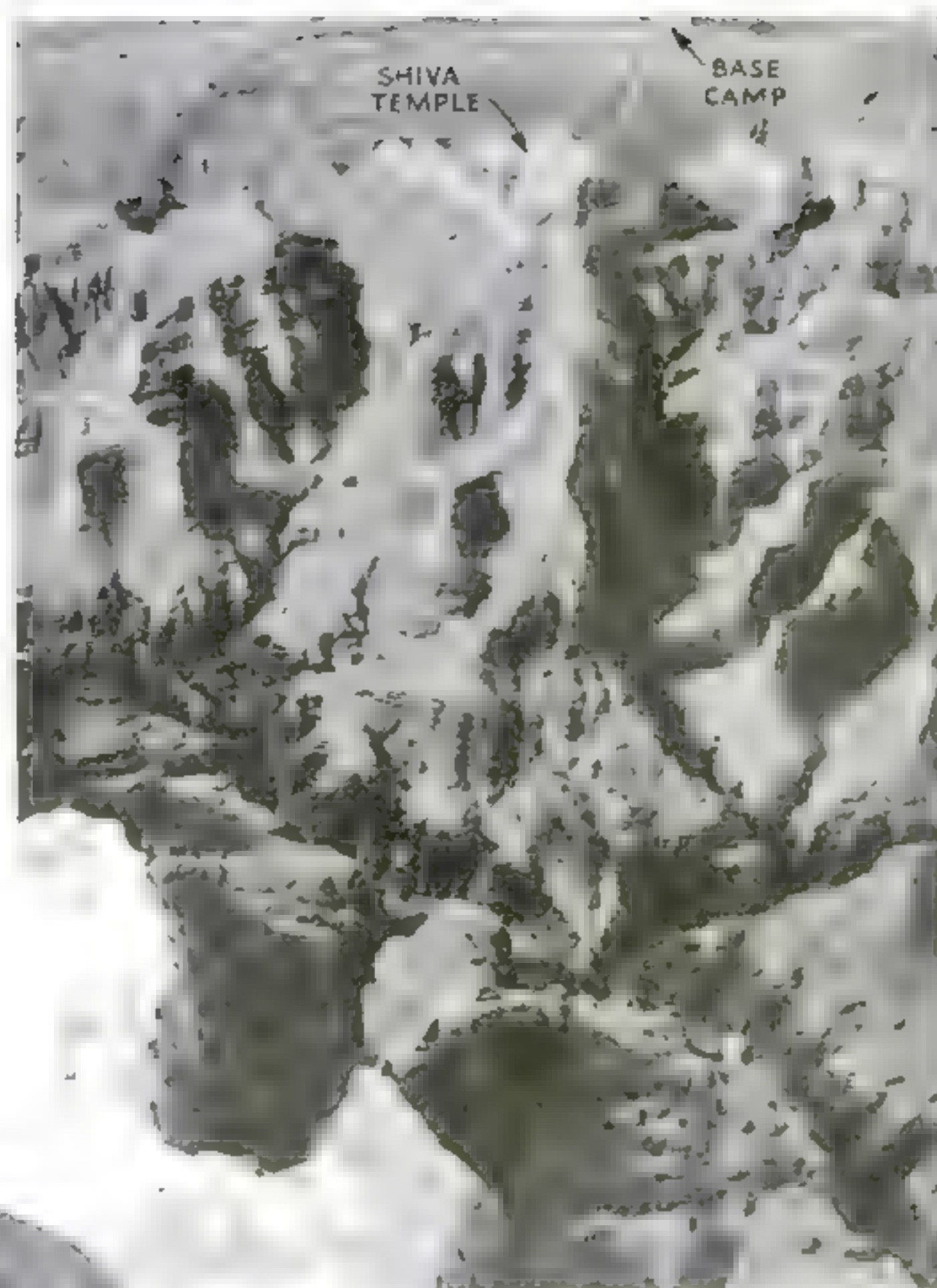
Doyle, and H. G. Wells have depicted the imaginary discoveries of lost worlds, peopled with cave men and prehistoric monsters. Legends, folk tales, and the stories of returning travelers describe mystery beasts supposed to inhabit inaccessible regions.

In central Africa, natives tell of the Chepekwe and the Nandi bear. The former is said to be a gigantic creature with the head and tail of a lizard which inhabits the Dilolo Swamp and is able to crunch the massive bones of a hippopotamus as though they were twigs. Some years ago, a big-game hunter investigated reports that a huge, mysterious animal was making raids on a native village. He smoothed a strip of sand between the jungle and the camp. The next morning, he discovered tracks, four times the size of a human footprint, showing the marks of three clawed toes. The natives declared the marauder was the Nandi bear.

While scientists usually dismiss such stories as products of the imagination of superstitious natives and excited hunters, they admit that, even today, there are

Shiva Temple as seen from the opposite rim of the canyon. The dotted line shows how the explorers will approach its base

A descendant of the dinosaur—a scaly, carnivorous lizard found on an East Indian island. Some are twelve feet long



Expert mountain climbers will lead the way to the almost inaccessible lost world in the Grand Canyon

vast stretches of relatively unknown country in which there may exist creatures of the past and weird animals new to science.

At the far tip of South America, in Patagonia, a traveler once discovered the remains of a giant ground sloth such as inhabited the earth in prehistoric times. So well preserved was it that Sir Edwin Ray Lankester, noted natural-history expert of the British Museum, declared that it must have been alive at a comparatively recent date. In the unmapped stretches of Patagonia, he suggested, such giants of the ancient past may still be living.

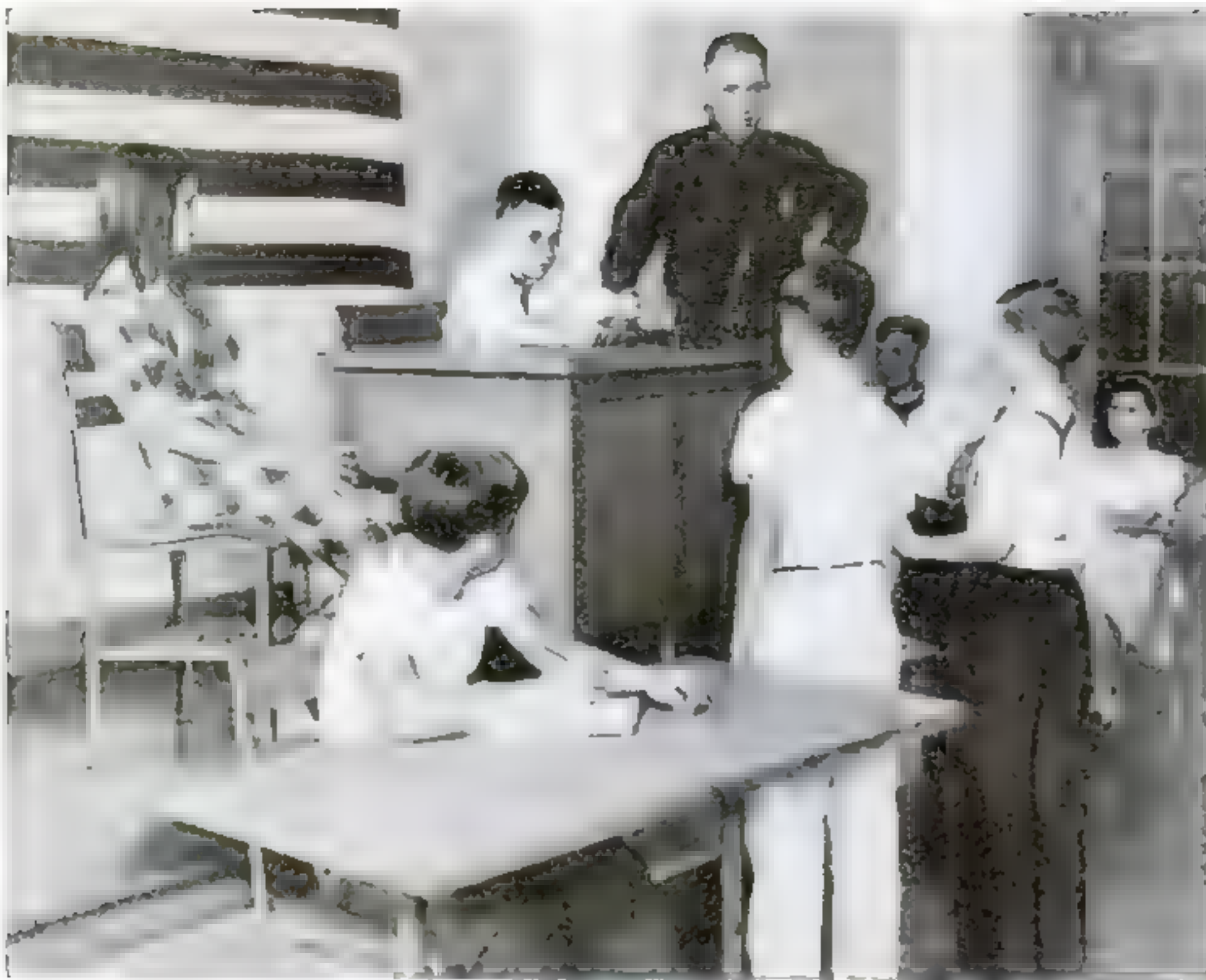
In 1912, the tales of Malay pearl divers led to the discovery of descendants of dinosaurs living on the far-away isle of Komodo. Expeditions visited this cobra-infested dot of land between Java and Timor and found twelve-foot dragon lizards, great carnivorous reptiles with scaly armor and forked yellow tongues. Both pictures and living specimens have

been brought back to England and America.

On the same part of the globe where these lost-world lizards were found, another mystery creature has been discovered. This is the scaled rhinoceros, living nowhere else in the world except in the fever-ridden jungles of Java. Twice, big-game hunters have killed the rare animals. But, so far, no living specimen has been captured.

Anthropologists, whose field of study includes vanished races of man, have added their contributions to the list of lost-world discoveries. Easter Island, in the Pacific, with its mysterious and ancient stone monuments; the isolated civilization of the Mayans; and the remains of age-old races in the arctic are some of the detached fields they have investigated where the past has carried over into the present.

During the early years of the twentieth century, arctic explorers brought back stories of a race of blond Eskimos that lived on the cold and lonely shores of Coronation Gulf, between Alaska and Hudson Bay. Expeditions investigated the report and found not only the light-skinned Eskimos—wearing curious swallowtail coats of fur, the tails of which they folded up to form mats when they sat down—but also the ruins of singular oval houses of stone. The blond Eskimos knew nothing of the builders of these stone-age homes. They are believed to have been an earlier people carried from Asia across the far stretches of the north by some prehistoric tide of immigration. As it receded, it left behind isolated (Continued on page 138)



Children Conduct Traffic Courts

SCHOOL CHILDREN conduct a dozen unique traffic courts in Hamtramck, Mich. Pupils who violate safety rules by jaywalking, hitching auto rides, or crossing streets against the lights, are given tickets and must appear before the student judges. If found guilty, they are penalized by losing some of their privileges or by being given extra work to do. As a result of the scheme, this city of 50,000 inhabitants has established a remarkable record for safety among children of school age.

Tells If Jelly Will Jell

WHETHER jelly will jell can be determined in advance by the use of a simple device that gauges the thickness of fruit juice. The "jellyometer" consists of a small graduated tube. A sample of the juice is placed in the tube and allowed to drip out. The speed with which the juice drips from the tube gives an accurate index of its thickness.

A boy judge holding court at Hamtramck, Mich. Violators of safety rules are given extra work



Pneumonia Germs Raised To Produce Vaccine

A VACCINE to provide immunity against pneumonia is being tested by U. S. Army Medical Corps doctors. Serums have been produced to cure the disease, but a successful preventive method would be an invaluable new weapon. Fifty gallons of veal broth in which pneumonia germs are raised yield a third of an ounce of the Army vaccine, which is sufficient for about 4,000 treatments.



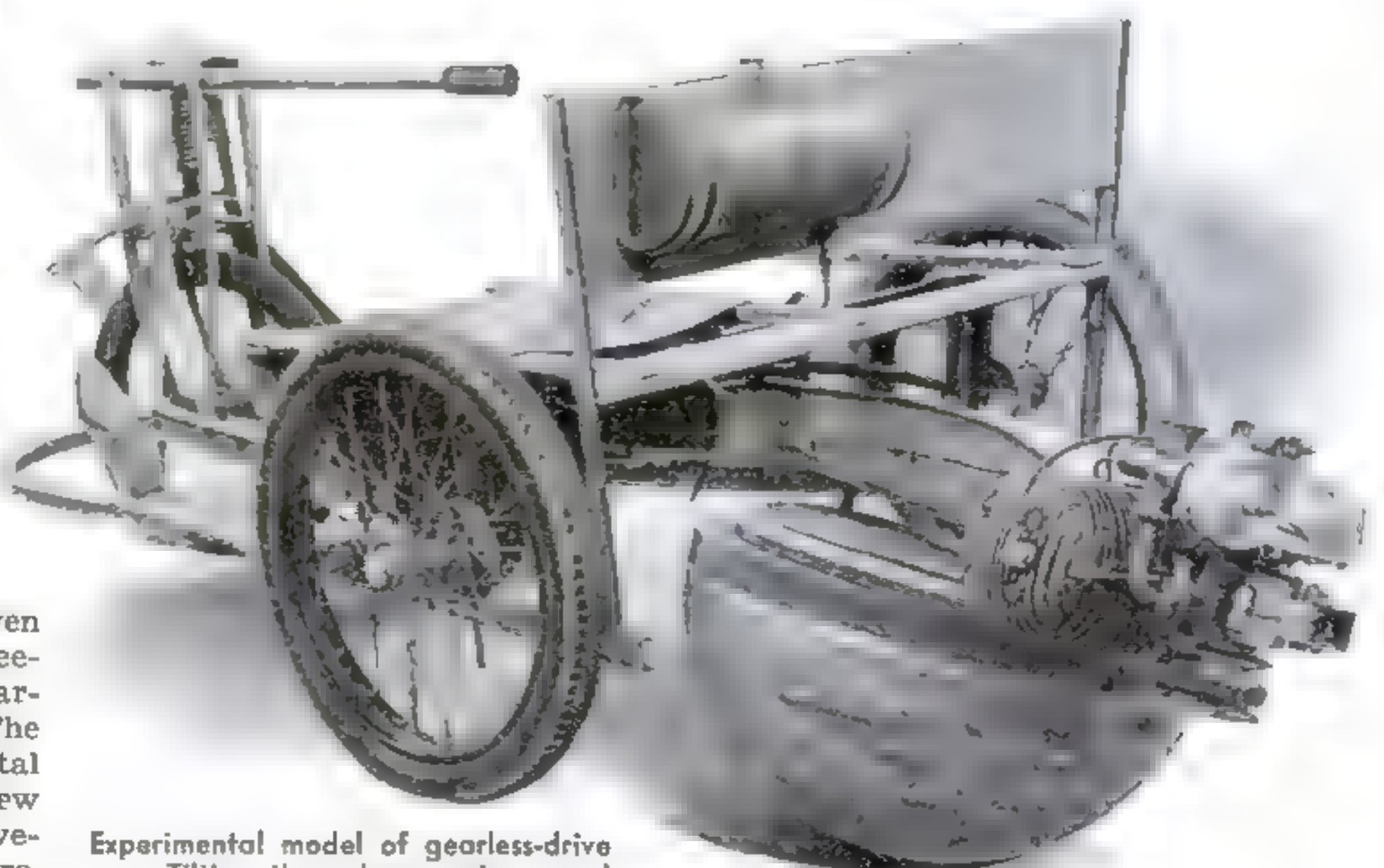
Vaccine is produced by cultures of germs in huge jugs of veal broth

Cobbler Uses Jig Saw for Trimming Soles

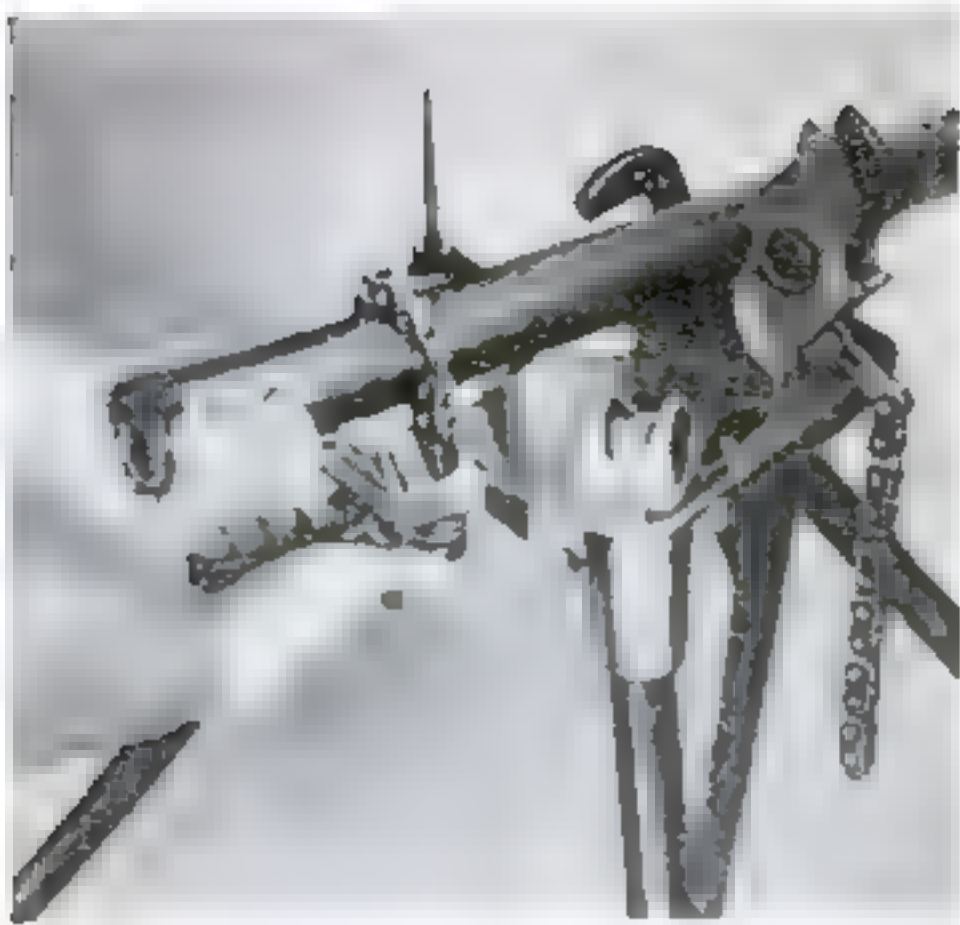
BY USING a modified jig saw, a San Jose, Calif., shoemaker saves time and labor in trimming soles. In one operation his apparatus trims the sole and forms a channel in the bottom to carry the stitching.

Spherical Drive Wheel Propels Odd Vehicle

PROPELLED by a spinning, motor-driven half globe at its rear, a strange three-wheeled vehicle recently made its appearance on the streets of Paris, France. The fantastic machine serves as an experimental model to test the inventor's idea of a new gearless transmission, the speed of the vehicle being varied by tilting the hemisphere.



Experimental model of gearless-drive car. Tilting the sphere varies speed



Plumber's Stand Has Built-in Pipe Bender

COMBINING a vise, pipe bender, and tool rack, a new portable stand is a convenient tool for plumbers. Three tubular legs give the unit firm support; they can be fastened to the floor by means of lugs provided. The legs fold inward for carrying, like those of a camera tripod, and are fastened together by a chain. The malleable-iron head is shaped to act as a convenient pipe bender, while slots in it serve as handy wrench racks. A special recess in the head holds a can of cutting oil. The bender's tubular construction is said to make it unusually light.

Compact Brake Tester Resembles Flash Light

STOPPING ability of automobiles is measured by a new brake-testing device for law-enforcement officials. Resembling a flash light, the brake tester is placed on the floor of a car, where it shines a green light when the automobile proves its ability to stop quickly, or a red signal if the brakes are inadequate. A small quantity of mercury is contained in an ingenious switching mechanism built into the tester. When the car stops, the mercury tends to keep on moving, and the more quickly the automobile slows down, the greater is the forward surge of the liquid metal. If the car has good brakes, the mercury turns on a green light, otherwise a red signal is illuminated. Supplied to police officers, the unit is expected to prove useful in promoting more frequent servicing of brakes.



Laid on the floor of a car that is being tested, this device flashes a red light if brakes are bad, green if they are good

Novel Wheelbarrow Walks Up and Down Stairs



The swinging arms that support the rear wheels are mounted on springs so they move forward to provide a "walking" motion for the unit

When its handles are raised and lowered alternately, the wheelbarrow travels up or down a set of stairs

CLIMBING up and down stairs, a novel wheelbarrow invented by a California man is handy for carrying loads in and out of buildings. A pair of small, spring-mounted wheels replace the usual legs at the back, and in ascending a stair, the user bears down on the handles, raising the front wheel, and pushes forward until this wheel rests on the second step. When the handles are lifted, the rear wheels spring forward to the first step, and the process is repeated until the top is reached. Stairs are descended with the handles forward, the operator backing down ahead of the load and reversing the process used in going up.



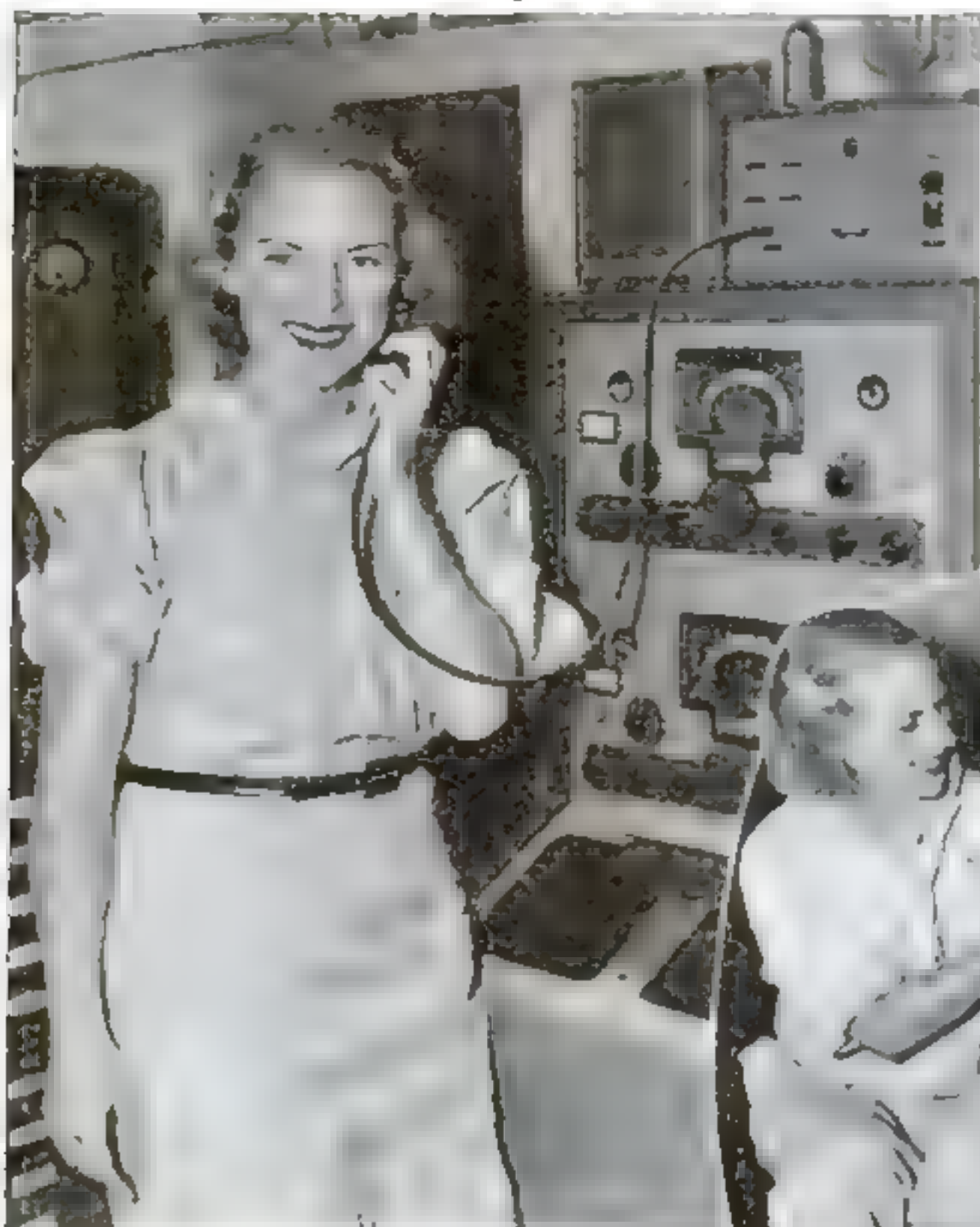
Handy Office Device Removes Paper Clips

PRESSURE of the fingers removes staple-type paper fasteners with a new device intended for office use. A pair of curved jaws wedges the wire clip open without tearing the paper, and holds it firmly so it will not fly in the user's face.

River of Fresh Water Discovered at Pole

FLOWING with fresh water in the midst of the Arctic Ocean, with no land for miles around, a river discovered by Russian scientists at the North Pole represents a geographical novelty. The explorers used the water for house-keeping, and navigated the river, which is formed by melting ice, in a canoe for several miles.

Girl Is Airport Jack-of-All-Trades



Rosa Laird giving a weather forecast to a pilot from the Wilmington, Del., field. At the right, she is wielding a grease gun

Said to be the only woman airport operator in the East, Rosa Laird, a twenty-one-year-old girl, handles several jobs at once at the Du Pont Airport at Wilmington, Del. She takes her turn at greasing planes, radio dispatching, running a refreshment stand, and recording weather forecasts.



This tractor was a time-saver on a drilling job



Tractor Goes to Sea With Boring Machine

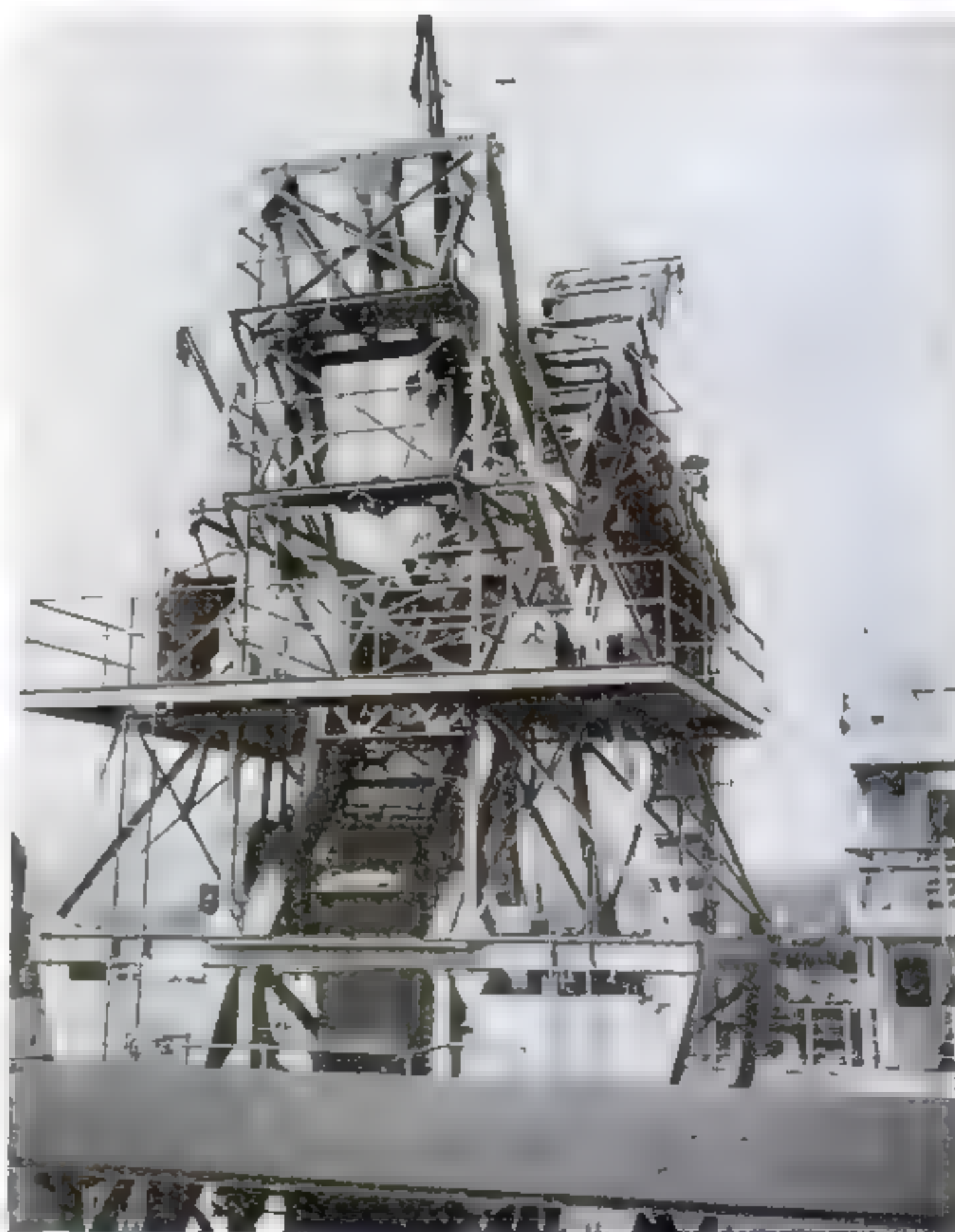
A SEAGOING tractor recently helped speed up the work of building a break-water foundation at North Beach, Md. On its crawler-type treads, it carried an earth-boring machine through shallow water and enabled it to bore fifty nine-foot holes, sixteen inches in diameter, in an eight-hour working day.

Giant Belt Conveyors Unload Banana Boats

CAPABLE of loadingsixty-fourfreight cars with bananas simultaneously, two cantilever-type belt conveyors were installed recently at the Los Angeles, Calif., harbor. When a ship arrives, the huge machines dip their belts into the open hatches and carry as many as 6,000 bunches of bananas an hour from the ship's hold into waiting freight cars.

Apartment Is Built of Steel

STEEL construction like that of an automobile is used in a new apartment house in London, England. Walls, floors, and roof are of pressed steel, along with the interior trim. Special insulation conserves heat and keeps sound from passing through the partitions.



Conveyors with belts lifted. When the long arm is lowered into the hold of a ship, it can unload 6,000 stems of bananas in an hour



Working the handle of this odd spade fork lifts and turns a pivoted blade

Mechanical Spade Fork Aids Home Gardeners

To reduce the labor of spading up a garden, a European inventor has devised an automatic fork. The mechanism is actuated by manipulating a curiously shaped handle which lifts the blade and turns it to dump earth.



Troops Cross Ravine in Cable Car

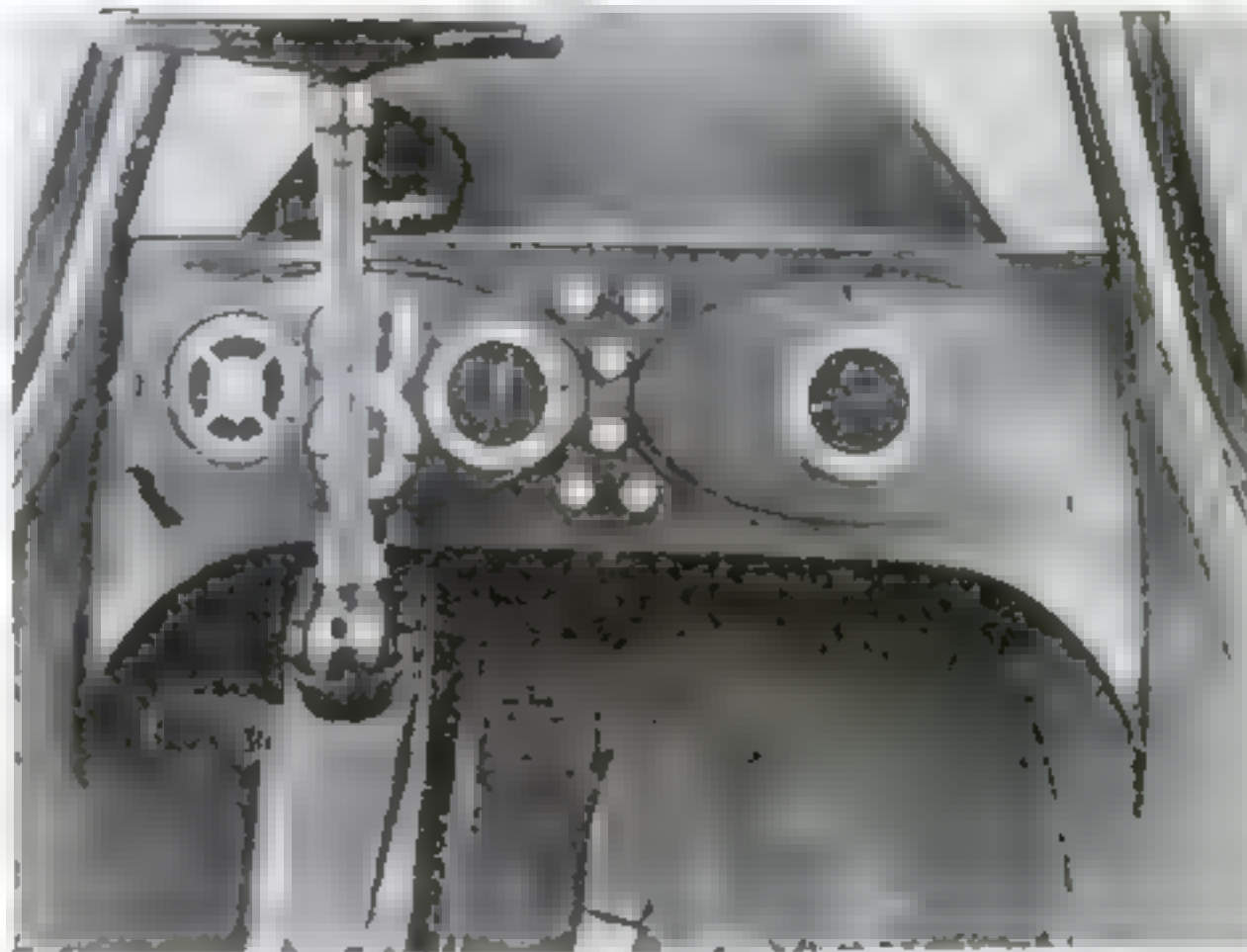
BY CONSTRUCTING an aerial cableway in ten minutes' time, in a public demonstration at Chatham, England, British Army engineers recently showed how troops can be transported across an impassable declivity. Hanging from two overhead ropes and towed by a third, the car of their overhead railway carries two men at a trip, as shown in the illustration above. The cars are for use in maneuvering bridge pontoons.

Extract Devours Germs

A "GERM EATER" that literally devours bacteria has been isolated by Dr. John H. Northrop, of the Rockefeller Institute. Extracted from bacteria, the solid is said to be capable of digesting the germs from which it came, completely destroying them.



A wheel under the nose prevents somersaulting in a poor landing



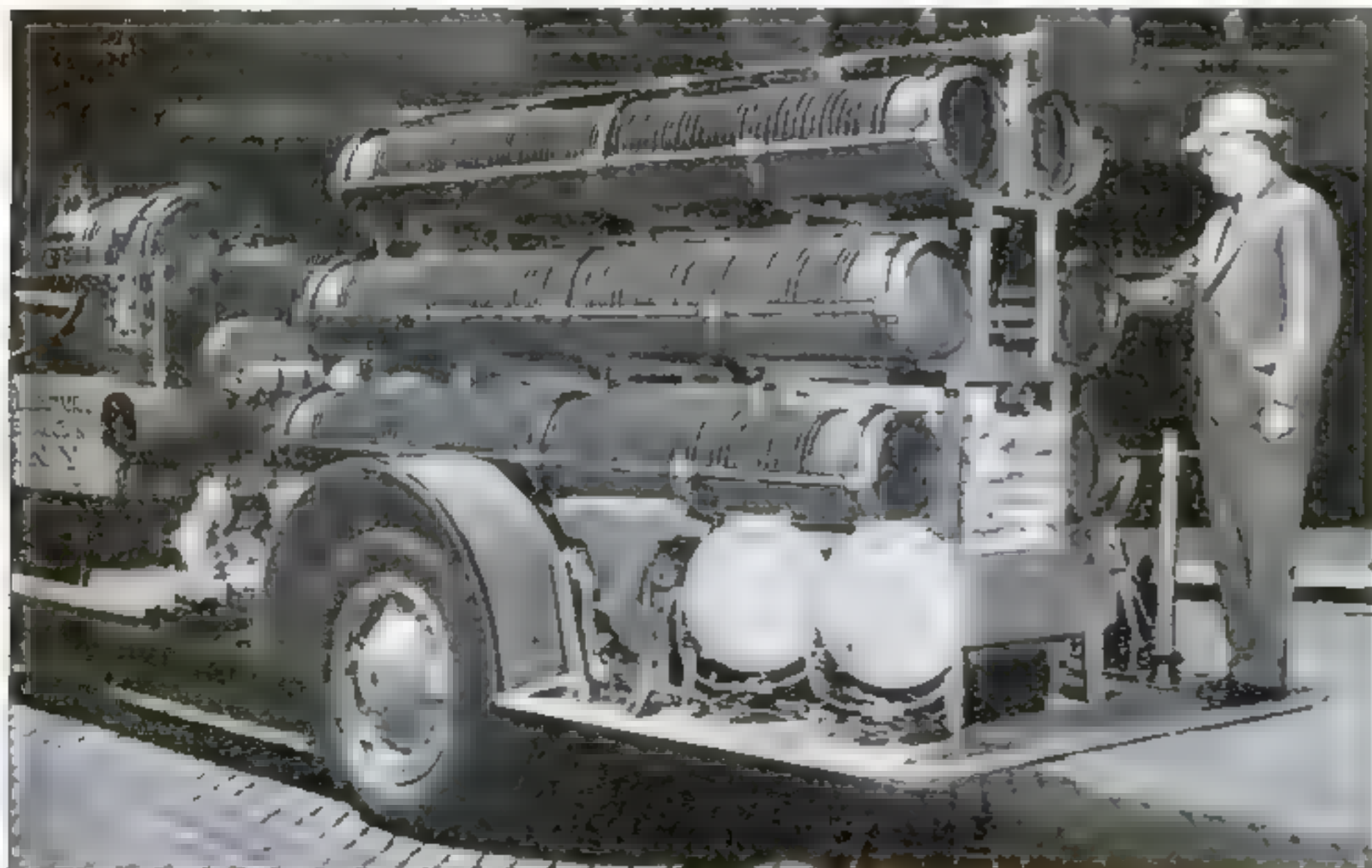
Automobile-type controls make the craft easy to operate

CONTROLS like those of an automobile operate a 120-mile-an-hour "safety plane" designed for amateur pilots. Gas is fed to the motor by a conventional foot-pedal accelerator, while a steering wheel turns the plane and also guides it up or down. A tri-cycle landing gear with one wheel under the plane's nose keeps the craft from somersaulting if the pilot makes an inexperienced landing.

Fire Truck Carries Smoke-Blowing Equipment

TO AID in fighting smoky blazes, New York City's latest fire truck sucks out the fumes or blows in fresh air, as conditions require, by means of a powerful blower and a sectional hose of reën-

forced rubber. Called the first of its kind, the truck also carries a foam generator for producing a fire-extinguishing froth used against oil and chemical fires, where water cannot be employed.



This double-duty truck carries a fan and hose for pumping smoke, and also a foam generator



Measuring V angle and, right, width of pulley belt on graduated scales. The circumference board below gives the inside length



Handy Gauges Measure Pulley Belts

DRIVE belts for pulleys are quickly measured with a new pair of gauges. A scissorslike device indicates the width to the nearest sixteenth of an inch, and the angle of a V-belt in two-degree steps, while a circumference board shows the inside length of a belt stretched around it.

Crowd Sees Speaker in New Address System

THRONGS of spectators may clearly view an orator, as well as hear him, through a new German public-address system based upon television principles. The installation presents an image of the speaker, magnified many times life size, upon an elevated screen in plain sight of the entire audience, while his voice is being heard through loud-speakers of conventional design.

Besides the customary microphones, a pair of large photo-electric cells or "electric eyes" flank the speaker's stand. As the orator discourses, he faces a projector from which an almost invisible beam of green light plays back and forth inconspicuously across him. The photo-electric cells, which are sensitive to this light alone, respond to

the rays reflected from his features by transmitting a series of electrical impulses. These are reconverted to light by a 20,000-volt cathode-ray tube, and a powerful lens throws the image upon the screen.

Originators of the system also predict its application in the theater to make every seat a good seat.

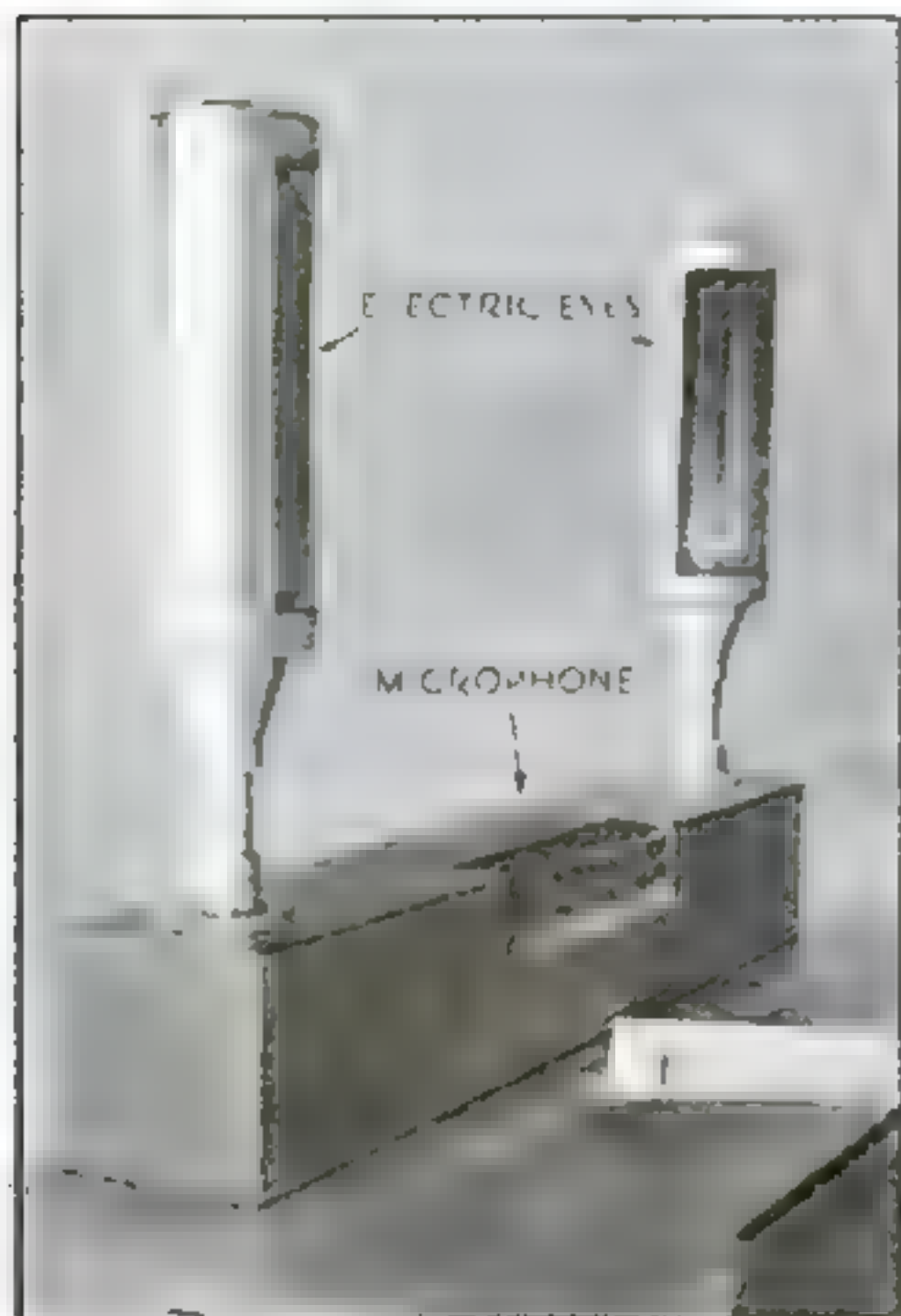
③ CATHODE-RAY TUBE REPRODUCES IMAGE OF SPEAKER

④ MAGNIFIED IMAGE OF SPEAKER APPEARS ON TRANSLUCENT SCREEN

ELECTRIC EYES PICK UP IMAGE OF SPEAKER

① PROJECTOR PLAYS SPOT OF LIGHT OVER FEATURES OF SPEAKER TO SCAN PICTURE TO BE TRANSMITTED

How the visual public-address system works. At the left is a close-up view of the speaker's stand, showing the two "electric eyes"



Submarine Mower Cuts Underwater Weeds

TO PREVENT aquatic weeds from entangling the propellers of speedboats, Gar Wood, famous motor-boat racer, has devised a "submarine lawn mower."

When the squat craft is towed along a race course, a revolving rake resembling a paddle wheel clears the water of submerged vegetation.



Removing weeds cut from a speedboat race course by the paddle-wheel rake of the craft at left



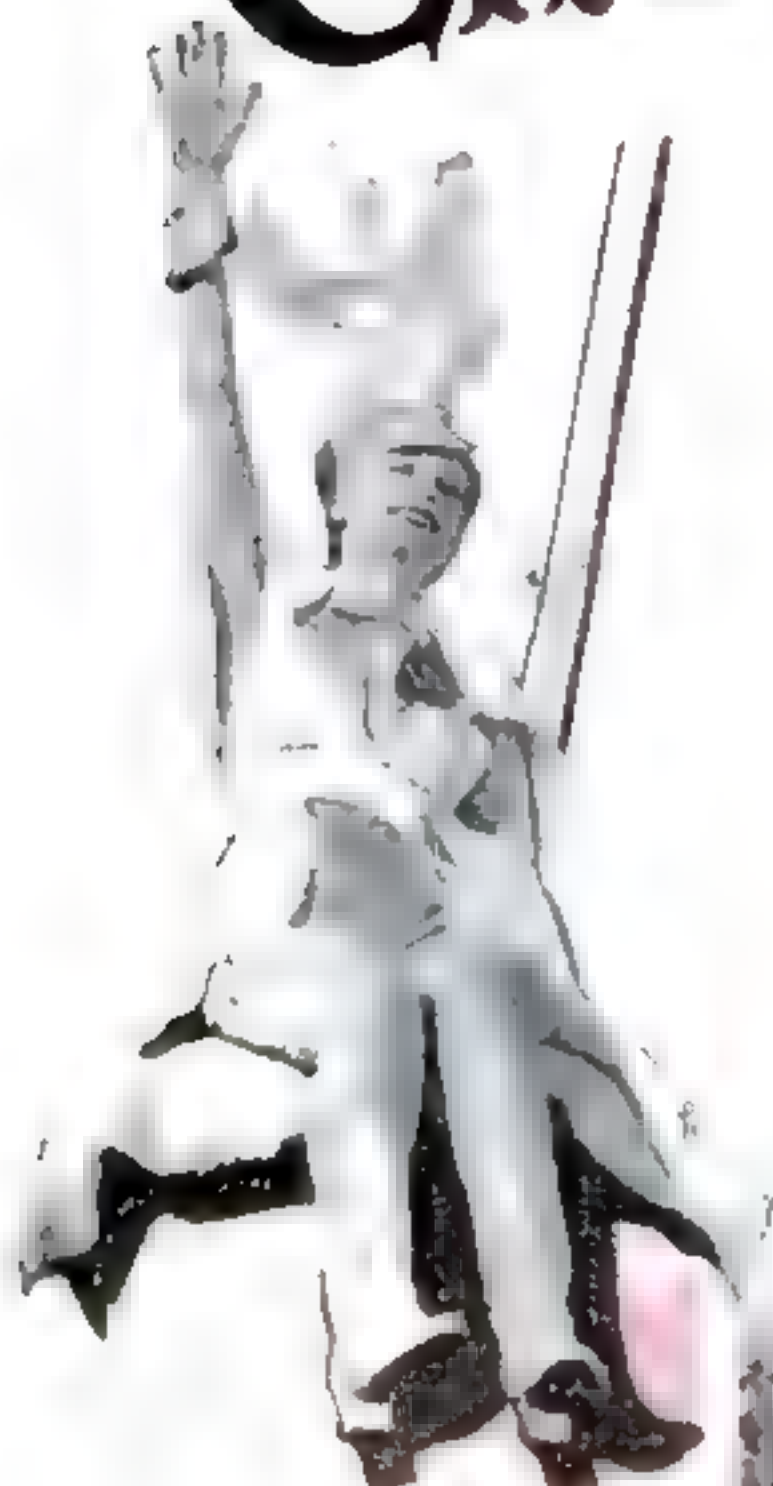
Flash-Bulb Chart Aids Amateur Photographers

CORRECT photographic flash-light exposures are made easy by a new pocket table. When the user has set a slide according to the grade of film in his camera and the distance to the subject, a chart indicates the number of flash bulbs to use with any desired lens aperture.



BEHIND THE SCENES at Circus Winter Quarters

By ROBERT E. MARTIN



Almost as
Fascinating
as the Show
Itself Is
the Big Job
of Getting
Ready for a
New Season

Trained lions re-
hearsing their act
before an interested
crowd at the Ring-
ling Brothers camp

THE band plays "Home Sweet Home." The last lingering, pop-eyed youngster trails away after his tired parents. The big wagons start rumbling toward the flat cars for the final trek back to winter quarters. It is late October and the circus season is over.

Five months pass and the big top rolls again. With flaming billboards, gleaming paint, eye-catching tinsel and costumes, it takes to the road. During the intervening weeks, an army of experts, engaged in intense but little-known activity, has rebuilt its vast equipment.

The road tour of the average large circus carries it across thirty or forty states. It travels between 12,000 and 20,000 miles and sets up and takes down its city of tents as many as 200 times in a single season.

There is no time for extensive repairs. So, each year when the circus hibernates, workmen virtually reconstruct the equipment from top to bottom. This behind-the-scenes activity is almost as fascinating as the show itself.

When you drive through the gateway, surmounted by two silver lion's heads, which forms the entrance to the Ringling Brothers camp at Sarasota, Fla., you find yourself in a busy community of sprawling wooden buildings. Inside them, you encounter everything from tent making to lion taming. The camp is an industrial village in itself. There is a woodworking plant, a paint shop, electrical departments, and dressmaking rooms. There are training barns and animal rings, a hospital, a dormitory, and acres of huge circus wagons, ranged row on row, receiving new fittings and paint.

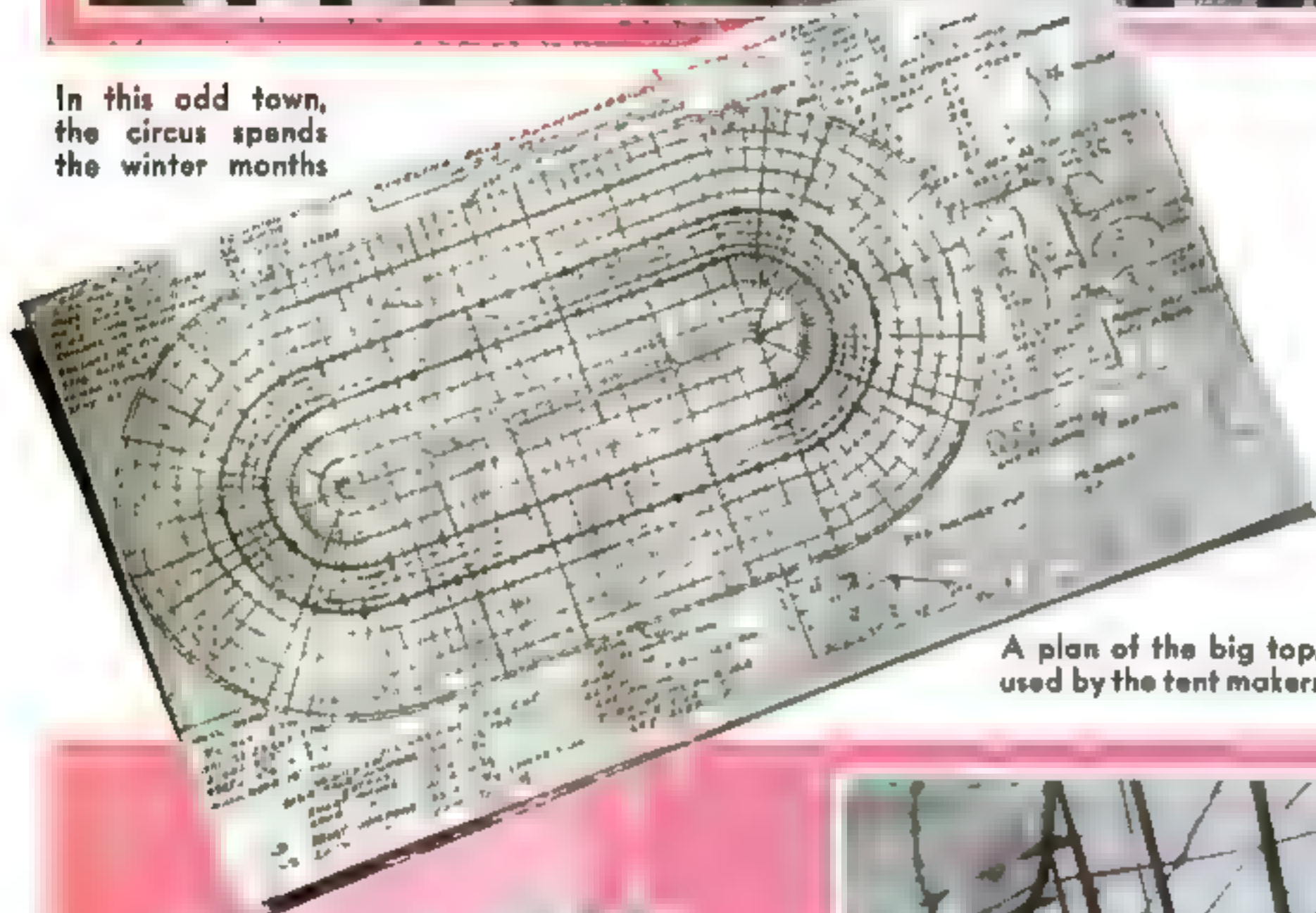
The big job of the winter season is the construction of the 21,000-pound main tent. This canvas mammoth will shelter 14,000 people. It is two blocks long and nearly 200 feet wide. More than six stories high, it is supported by 202 poles. The four largest are turned out of Pacific Coast spruce at a plant which



While waiting for the summer season, this dancing elephant spends its time learning some new steps



In this odd town, the circus spends the winter months



A plan of the big top, used by the tent makers

makes masts for sailing vessels.

In the tent shed, which suggests an airship hangar, William Hobson, the man in charge of constructing the big top, is guided by a drawing 113 feet long. It shows every detail of this largest tent in the world even down to the last eyelet. A special metal tube has been designed for storing the gigantic blueprint.

Seventeen sections, each weighing about 1,200 pounds when dry and often three times as much when wet and muddy, make up the big tent. The upper ends of the supporting poles have steel spikes which project through holes in the canvas. These holes are bound with tough elk's hide, and around the spike, to act as a pad between the canvas and the pole end, is a "doughnut" of rope. One man in the tent shed spends days coiling manila into these round buffers.

Not only the big top, but all of the other tents as well—the 140 by 405-foot menagerie tent, the 75 by 312-foot dining tent, the side show tent, the canvas stable, and even the tents that serve as dressing rooms—are discarded and replaced at the end of

every season. More than 100,000 yards of special-quality canvas and nearly ninety miles of rope are used each winter in preparing the tents that house America's biggest show.

The cloth used in the new tents is water-proofed with wax and treated with chemicals to make it fire-resistant. Most of the men who work in the tent building, sitting on low benches like cobblers, were originally sail-makers. The twenty-eight men and four women under the direction of Hobson are the only members of the circus personnel who never go on the road. Their job keeps them busy in Sarasota the year round.

The tents are rolled into compact bundles for transportation and packed in stout canvas



How the inside of the main tent looks before the seats are placed. For transportation, the canvas is rolled into bundles like those being examined at left by William Hobson, Ringling's tent designer

bags which have diameters ranging all the way from nine inches to six feet. During the winter, choppers at the Sarasota camp shape about 2,600 big stakes, 1,100 of which are spares to be taken on tour for replacements. The stakes are made of hickory, dogwood, ironwood, and white oak.

During the winter's work at camp, the circus draws from nearly every state in the Union for its supplies. Washington produces the big tent poles; Maine the spruce for seats; Arkansas the hickory for wagon wheels; Indiana the ironwood for stakes; Ohio the basswood for wagon carvings; North Carolina the white oak for wagon gears; Mississippi the cotton for canvas; and Pennsylvania and Illinois the steel for cage bars. In five months of rebuilding operations, a circus may spend \$25,000 at wholesale hardware houses for tools and supplies.

To save time for the men who assemble the seats in the main tent, all of the planks, jacks, and stringers are colored. Bleacher seats, for example, are blue; grandstand platforms for supporting the chairs are red; and the jacks which brace the stand on which the band plays are yellow. During the winter, this color-code painting is done to maintain the split-second efficiency of the circus on the road.

Nobody knows how many thousands of miles of brush strokes go into the painting work done at the winter quarters at Sarasota during a single season. Wagons, cages, and railway cars are adorned with eye-catching coats of paint. The expert who for years has put the stripes and curlicues on the wheel spokes is known as Zeke the Striper. He hangs each wheel on an elevated axle so it can be turned as he works from spoke to spoke.

When the Cole Brothers Circus reaches winter quarters, the star attraction of the parade, the golden band wagon, has to be covered with nearly



A scene in the main wagon shop where as many as sixty vehicles may be rebuilt in a month. Show wagons have to take hard knocks



These men are repairing harness in a shop that supplies trappings for the 300 ring and 400 draft horses



"Waxie" Panza, head of Ringling's harness department. Although he has been blind for twenty years, Panza is recognized as one of the best harness experts in the country



Freshly painted circus wagons lined up and ready for use in the spring. Many thousands of miles of brush strokes go into the work done in winter quarters

\$600 worth of gold leaf. Another big item of expense during the preparation for the summer tour is the cost of the elephant blankets. The plush used costs four dollars a yard. Each blanket takes seventy-five yards, in addition to 200 yards of braid and two gross of concave silver ornaments. A big circus will invest as much as \$6,000 to \$7,500 in elephant blankets alone.

Even more elaborate are the costumes of the performers, and all are made of the best and most durable materials. The idea that circus trappings are cheap and flimsy imitations is entirely erroneous. Only the finest velvets, silks, and plushes are employed. From November to April, as many as thirty expert dressmakers and designers work at the Sarasota camp under the direction of Lawrence Banchi, head of the wardrobe department and the man who creates most of the costume ideas for the circus. His job is to turn out elaborate and pleasing attire for everything from beautiful aerialists to waltzing elephants.

As the winter progresses, tables in the wardrobe room are piled high with Oriental turbans, African headdresses, and military caps, in addition to the larger pieces of the various costumes. Recently, colored cellulose film has been



This man's job is painting the fancy rings, stripes, and curlicues you see on wagon wheels

employed widely in circus costumes. The wardrobe department buys it in sheets and cuts it up to form tassels that dangle from the trappings of horses and elephants.

To aid the workers in fitting horses with trappings, a full-size dummy animal is included in the equipment of the wardrobe room. It is the official clothes horse of the circus. Sometimes riding artists come to Banchi's shop to practice mounting and dismounting the dummy horse

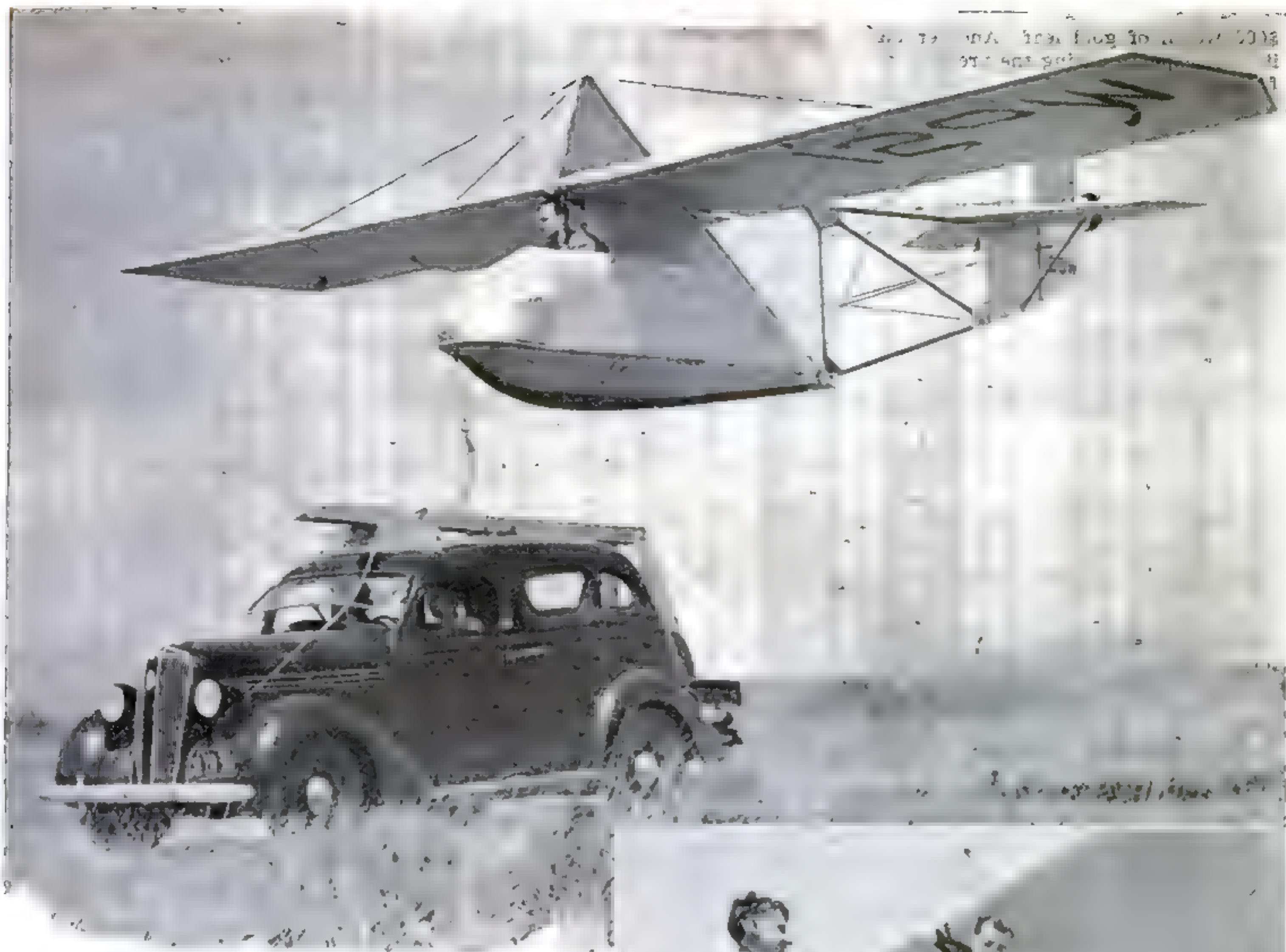
garbed in their new riding costumes.

One surprising thing about the wardrobe room is the few sewing machines present. Almost all the work is done by hand. Patterns are laid out on large tables and the cloth is cut to size with scissors. A good part of the work of the seamstresses is attaching fancy braid and jewel-like ornaments. After each garment is completed, it is pressed with a hand iron and stored away until needed.

By the time the costumes for a new season are finished, Banchi has used about 4,000 (Continued on page 139)



Dress rehearsal for the grand opening parade. Making the elaborate costumes keeps a staff of thirty dressmakers and designers busy from November to April. Contrary to common belief, circus costumes are made of the best materials. Two of the workers are shown in the circle



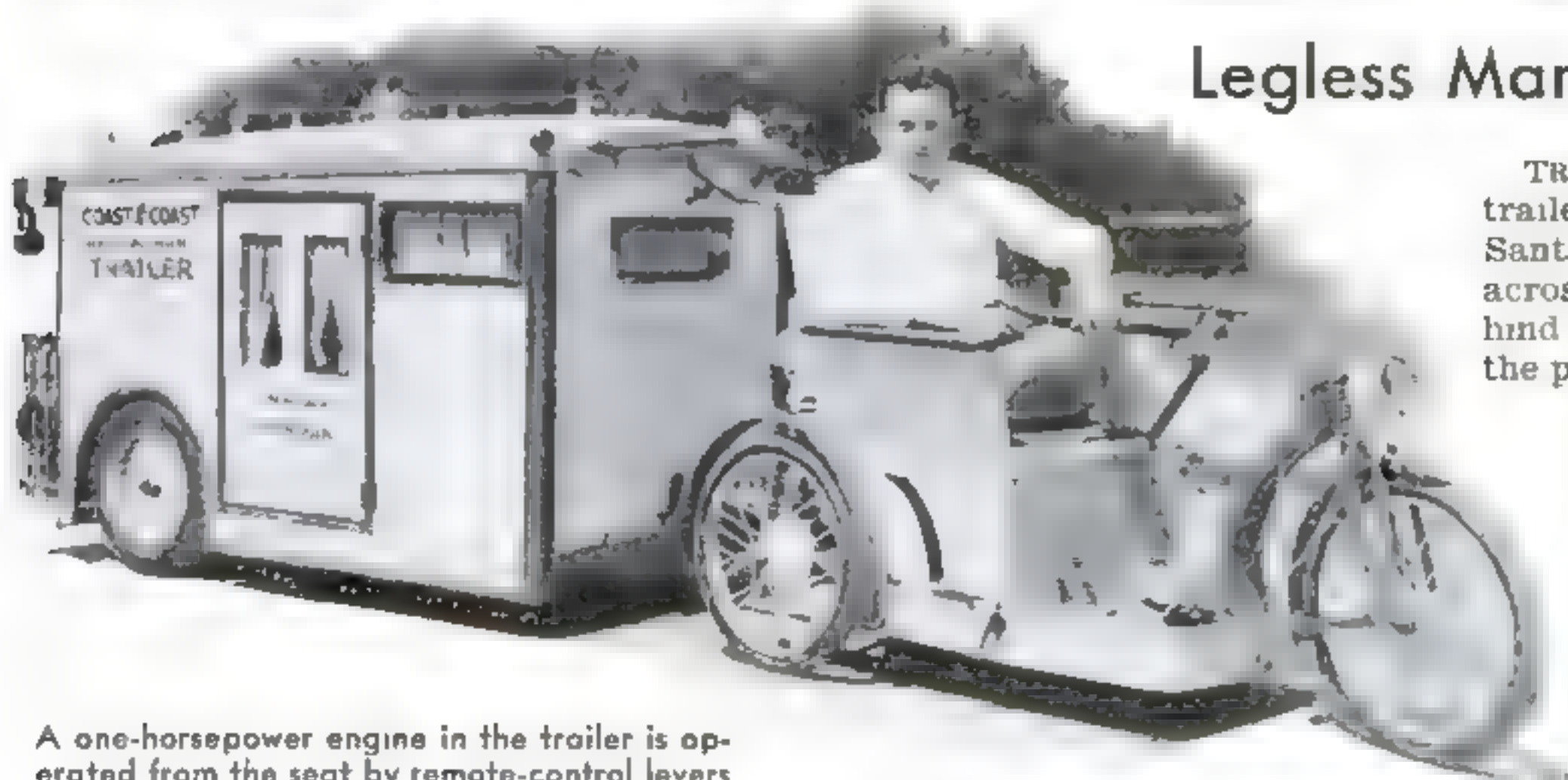
Glider Takes Off from Car's Roof

SOARING from the top of a speeding automobile, a glider takes off at high speed in a novel launching method devised by a California enthusiast. The V-shaped keel of the glider fits between the rails of a wooden track attached to the roof of the sedan. As the car speeds across a field at fifty miles an hour or more, the pilot releases the sailplane, which rises into the air. The glider shown in the photographs is of the primary-training type, having a wing spread of thirty-four feet, and weighing 230 pounds. The novel launching method is said to do away with the troubles encountered with the tow ropes and catapults previously used in taking off, in both competitions and individual flights.



How the glider is mounted on the wooden launching rack. The upper photograph shows the sailplane just after it has taken off from the car

Legless Man Tours in Odd Trailer



A one-horsepower engine in the trailer is operated from the seat by remote-control levers

TRAVELING alone in a unique, powered trailer, Freddie Carson, a legless newsboy of Santa Ana, Calif., is making a 2,500-mile-trip across the continent to Florida. Hitched behind a three-wheel invalid chair, as shown in the photograph, the trailer is equipped with a one-horsepower motor that provides a top speed of thirty miles an hour. Remote-control levers operate the engine from the seat of the chair. Although the motorized trailer is only seven feet long and four feet wide, it is equipped with running water, a bed, a radio, and other accessories. On his transcontinental trip, Carson expects to get more than 100 miles to a gallon of fuel.



Louis Weir at the keys of his small electric organ

Midget Organ Has Full Range

WEIGHING only 125 pounds, a diminutive electric organ has recently been completed by Louis Weir, of Boston, Mass. Tiny whirling wheels generate the fundamental notes, while the variations and harmonics of a full-size organ are produced by an intricate combination of switches and stops. An amplifier swells the volume of the instrument from a faint whisper to a resounding crescendo.

Chemical Process Preserves Plants



A whole birch tree being dipped in a chemical bath that will keep its leaves fresh

SHRUBS, flowering plants, and even whole trees are made fire-proof and preserved for decorative use by a new chemical treatment. Picked or cut when their foliage or blooms are at their best, the plants are immersed in a steaming chemical solution.



Passenger operating car's radio from rear seat

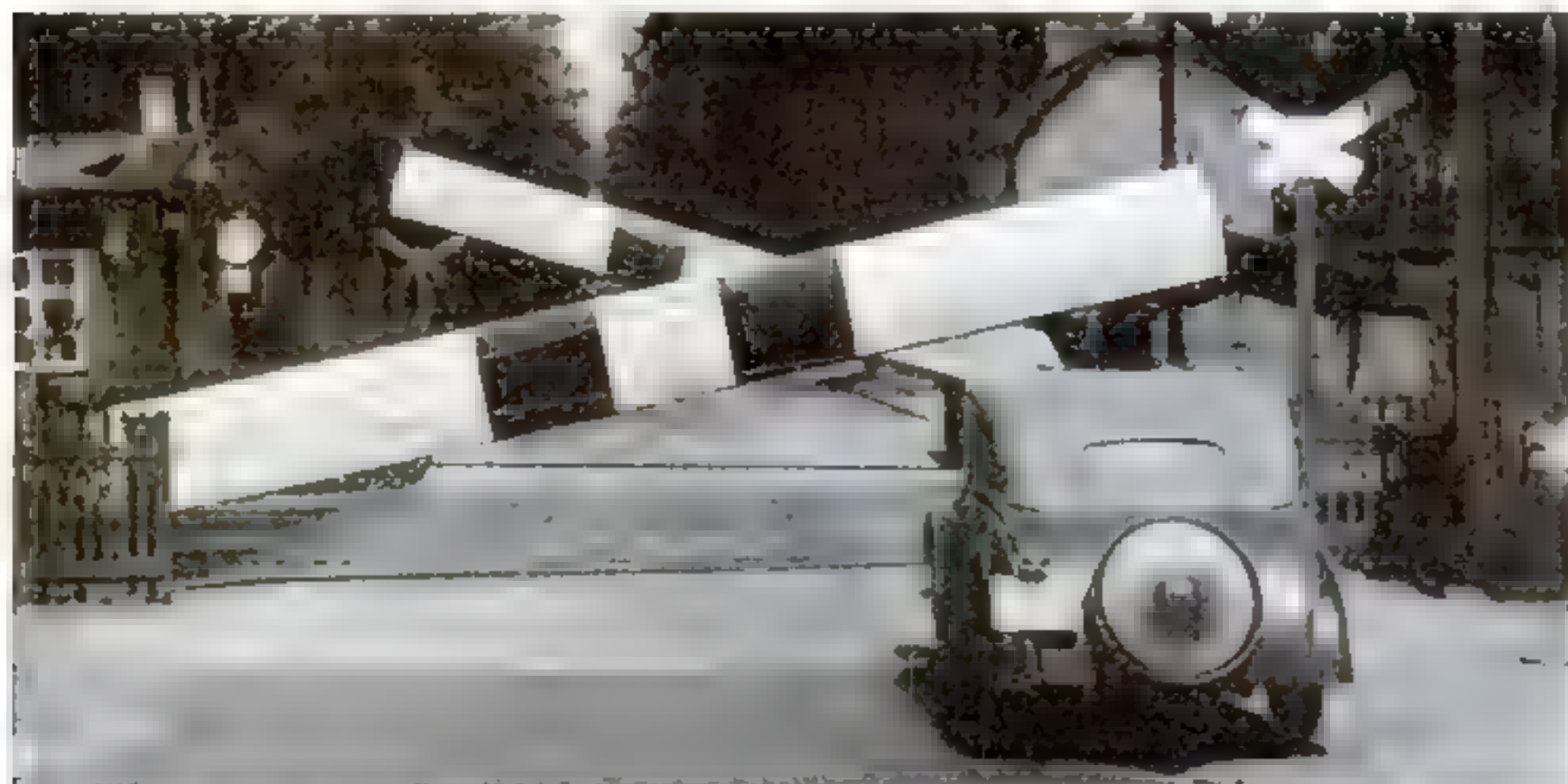
Back-Seat Dial For Auto Radio

BACK-SEAT control of automobile radios is made possible by a new device that fits all standard receivers. A conventional dial is mounted in the upholstery beside the rear seat of a car, and tunes the radio by means of a flexible shaft. The unit does not interfere with the regular dashboard control, and the two dials are synchronized so they always show the same station reading when either is turned.

Extra-Wide Gates Guard Railroad Crossings

MADE extra wide, a new railroad-crossing gate has just been introduced as an experiment by German railways. Marked with two broad black stripes, the white arm has a much stronger

construction than conventional types. It is expected to provide greater visibility and to discourage motorists from trying to race past the crossing as the gate is being lowered.



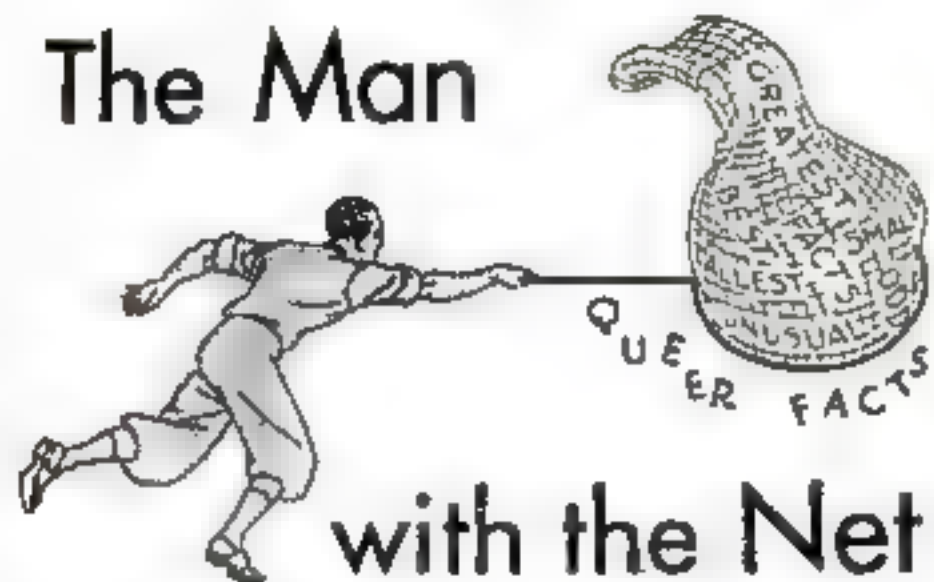
These Gargantuan barriers are easily seen under any conditions and discourage chance-takers



Novel Cribbage Board Makes Scoring Easier

SHAPED like a figure 8, a new-type cribbage board makes the scoring of the game more convenient than it is with a board of conventional design. Because the holes for the scoring pegs are arranged in two circles placed on either side of a handy ash tray, the records are well separated and can be used easily by both players. The board is decorated with attractive designs.

The Man



with the Net

COAL was used as fuel by Hopi Indians of Arizona before the time of Columbus.

MACHINERY can now remove all dust from gravel roads.



GOATS don't eat tin cans. They got that reputation by gnawing the labels to get at the sweet glue underneath.

TRENCHES fitted with plate-glass sides are being used to study how tree roots grow.

KANGAROOS sometimes take four hours to eat a meal.



MECHANICAL jaws, developed to test false teeth, duplicate all the motions of a person chewing.

ANDORRA, the tiny republic between France and Spain, is the only country in the world that has no telephones.

WEAK SOAP solutions are more effective than strong ones for washing away dirt.

SHOUTS could be heard from New York to Oregon if a man's voice was as powerful for his size as that of a tree frog.

DOGS have nervous breakdowns. An animal employed for scientific experiments in France worried himself sick when he thought another canine had taken his job.



SPERMATIZOIA of certain insects are larger than those of whales.

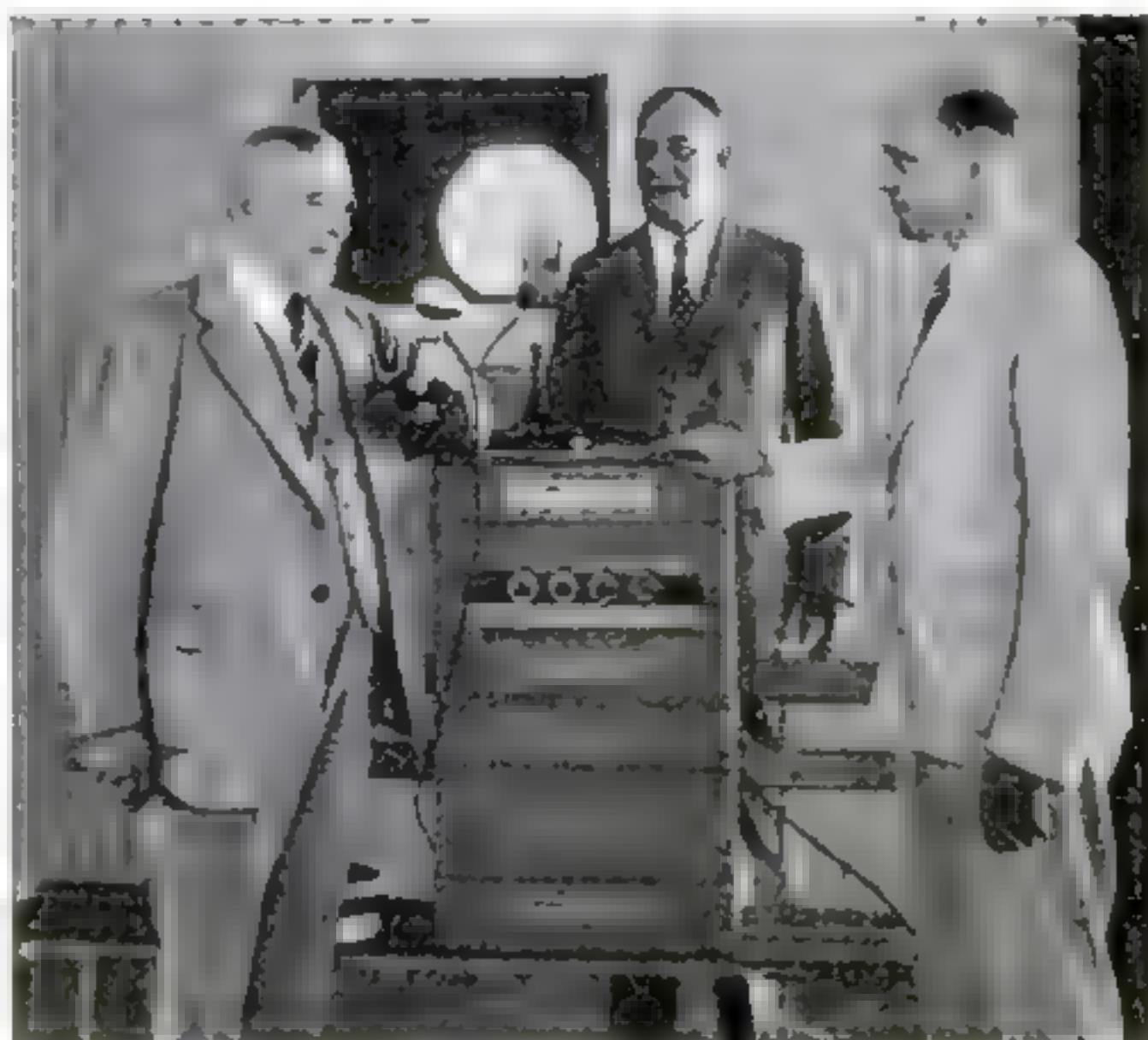
ROMAN WOMEN used lettuce juice to remove freckles.

RATTLES have been used more by adults than by children, history shows.

SO WHAT?



Loudspeaker Throws Voice a Mile



Amplifying apparatus and, below, loudspeaker for controlling crowds

CAPABLE of projecting the human voice more than a mile, a new high-powered loudspeaker recently tested at Atlantic City, N. J., will be used by life guards to control large beach areas and the adjoining waters. It is also designed for use as a means of communication between planes and the ground, for directing harbor traffic, and in addressing large outdoor gatherings. A specially constructed horn, and what is probably the world's largest permanent magnet, give the loudspeaker its great range.



Electric Chart Aids Car Lubrication

DESIGNED to simplify the lubrication of various makes of automobiles at service stations, a new electric chart gives the attendant correct specifications for the proper grades of oil and grease at a glance. For each make and model of car there is a card perforated with holes like those of a player-piano roll. When the card is inserted in the machine, the holes automatically operate a set of electrical contacts, illuminating various portions of the panel to indicate the proper lubricant.



Perforated card lights panel to show proper oil for every point

Aquarium Gets Genuine Sea Serpent

A REAL sea serpent—at least, an ocean snake—recently arrived at the New York Aquarium. Only two feet long, the odd black-and-orange reptile is a member of the cobra family and has a poisonous bite. The snake cannot live on dry land.



A relative of the cobra, this two-foot reptile lives in the ocean

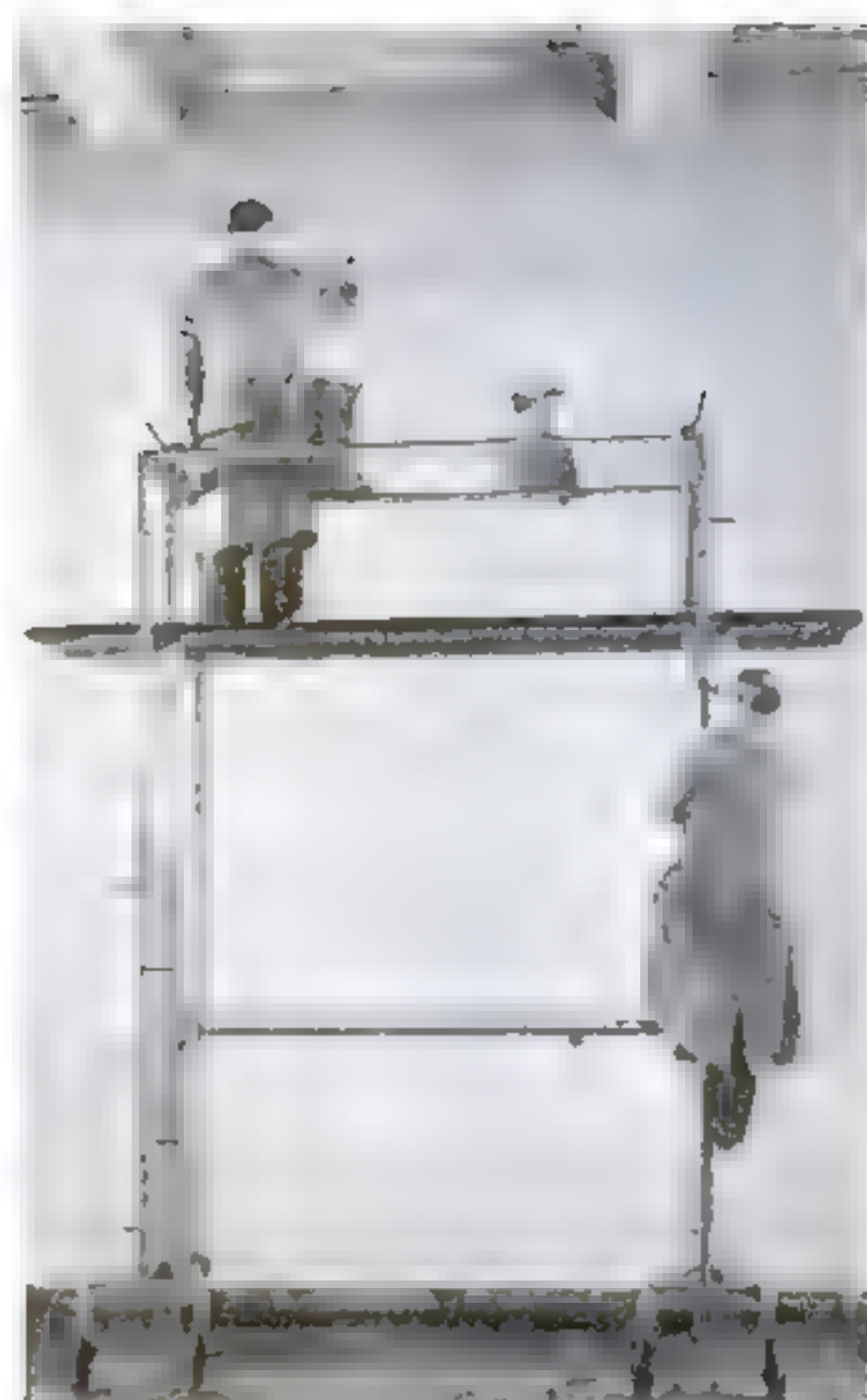
Novel Homemade Car Climbs Steep Mountain

A small gasoline motor powered the midget car on its 3,000-foot ascent



SHAPED like a toboggan, an odd-looking home-built midget car recently made the steep ascent of Ben Lomond, high Scottish mountain. The car was driven on its 3,000-foot climb by its builder, Wallace Henderson, a Glasgow engineer who made the low-slung vehicle in his spare time. He rates the gasoline engine at $2\frac{3}{4}$ horsepower; it is mounted in the rear, behind the driver's

seat, and operates the car by chain drive. Dual drive wheels, like those on trucks, give the light auto extra traction on heavy grades, while sheet-metal lugs on the inside pair of tires prevent the wheels from spinning on loose, yielding ground. The car has no body, but a curved shield at the front keeps out flying gravel. It is said to be of sturdy construction.



Scaffold Moves Itself

WITH a new hydraulic scaffold, painters and repairmen can adjust the position of their working platform without leaving their perch. Rubber-tired wheels move the entire unit in any direction when geared cranks are operated, and the platform can be raised or lowered by similar means.



Desk Opens Up To Form Artist's Drawing Table

PORTABLE and compact, a desk designed by a New York artist is a complete studio in itself. The accompanying photographs show how it looks when closed, and when open for use. A large drawing board slides up from behind the desk and folds forward to rest at a convenient angle for sketching. T squares, triangles, and smaller drawing boards are stored in a vertical drawer at the back. At the right of the unit is a compartment whose door opens to reveal a hinged shelf, convenient for holding ink, paints, and brushes when working. When closed, the desk forms an attractive piece of furniture that can be moved from room to room.



1 When folded, the desk is an attractive piece of furniture for the household

2 Opening the side door reveals a handy shelf for paints

3 The back conceals a drawing board that rests on the top

4 A large drawer at the right houses T squares and triangles



Musicians Play Glass Instruments in Unique Concert

A player striking a transparent bell that was used in a musical program broadcast recently from Germany



Glass trumpets are said to produce good tone

TRANSSPARENT trumpets, bells, and xylophones made of tubes of glass, took part recently in a unique orchestra concert broadcast over an international radio hook-up. The musicians, playing at Jena, Germany, all used instruments of glass turned out at nearby factories which produce some of the world's best camera and tele-

scope lenses. Years of experiment are said to have preceded the making of the glass orchestra equipment. Experts declare the tones are as beautiful as those of conventional instruments.



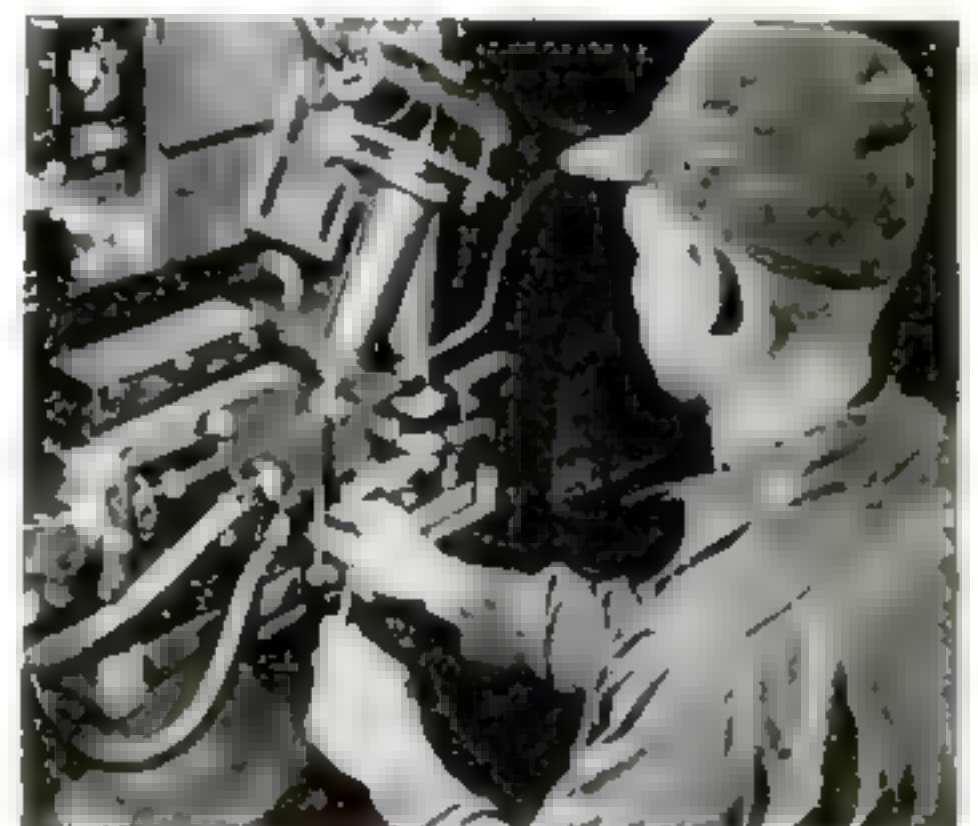
Tubes of glass form the bars of this xylophone. It is played with hammers like a regular instrument

Rich Silver Vein Found Near San Francisco



Mining experts examining a sample of ore from the newly found vein

A **RICH** vein of silver ore, thirty-seven feet wide and 1,600 feet long, has just been discovered almost within the limits of one of the largest cities in America, San Francisco, Calif. The site of the find is a twenty-acre tract south of the city. When specimens of the ore were assayed, they yielded from twenty to forty ounces of silver to the ton, in addition to considerable amounts of lead and zinc. Mining operations for the removal of the ore on a large-scale basis will begin in the near future.



Electric Eye Controls Tempering of Steel

CONTROLLING the temper of steel automatically, a new electric-eye unit is helping to get uniform quality in valve stems for automobile motors. As the metal is heated electrically, it changes color. When the glow reaches a given intensity, it affects the light-sensitive cell, which automatically turns off the heater and drops the metal into the cooling bath.



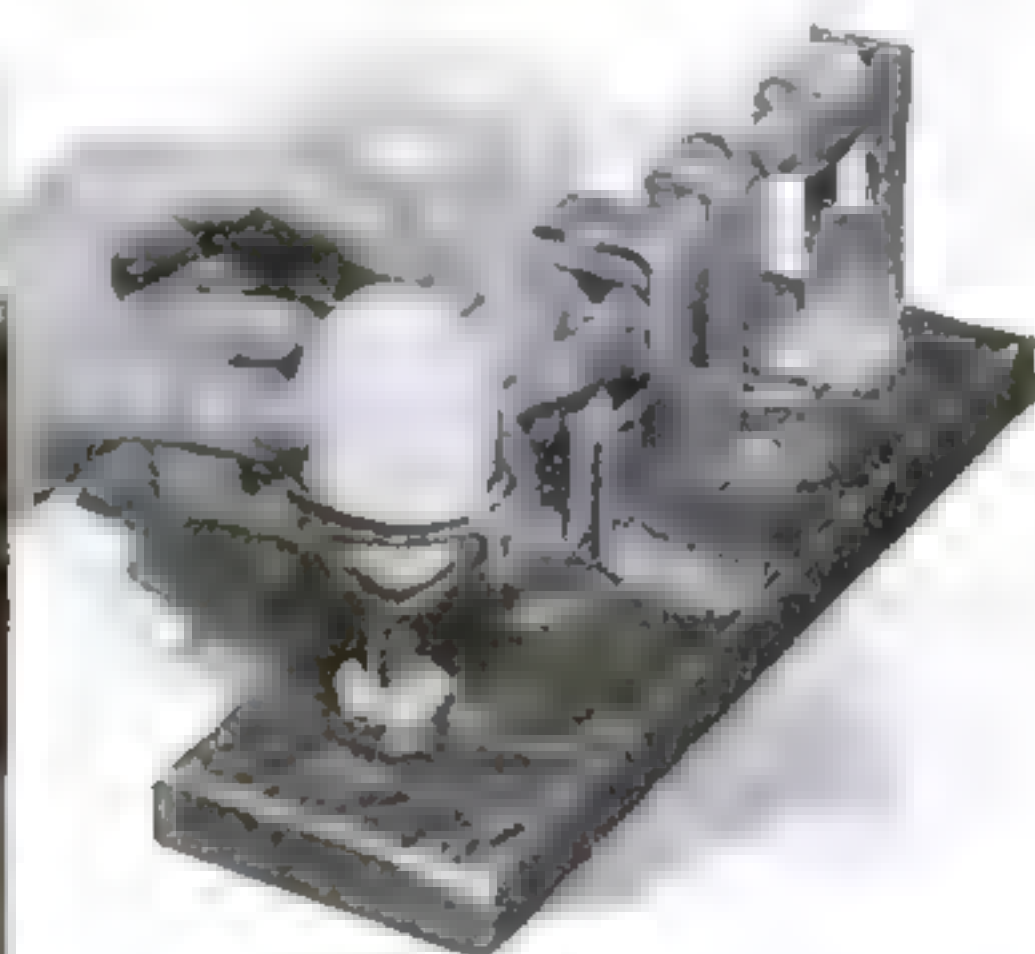
Laying Eggs

FACTORY production methods applied to the hen house produce 130,000 eggs a day at a scientific poultry ranch near Hollywood, Calif. From the hatching of the chick every detail of the hen's productive life is regulated to create ideal laying conditions, and the working population of 200,000 fowls lives a life as regimented and artificial as that of futuristic human communities described by imaginative writers.

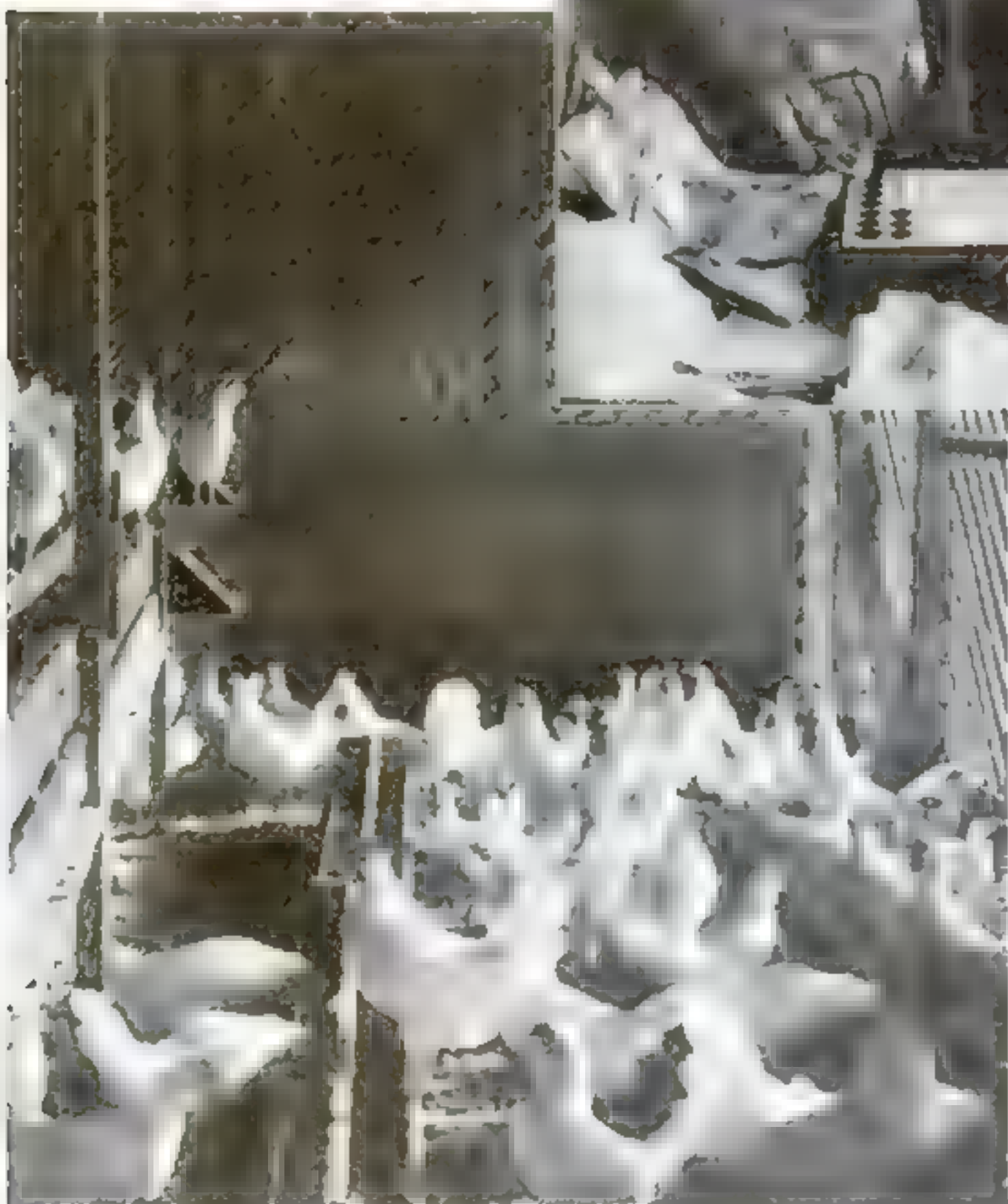
Eggs to be used for breeding purposes are selected carefully and hatched under laboratory control in giant incubators. Hen chicks start their careers in spotlessly clean brooder pens, from which they graduate first to the pullet

This worker is checking the sex of day-old chicks to separate the hens from the cockerels. As many as 12,000 chicks may be examined and graded at the farm in one day

At the right, a hen is getting a blood test for pullorum, a poultry disease, with an electrical device. Hens that have the malady are not used for breeding



A single pair of scales like this will weigh 7,200 individual eggs in a day. The eggs also are sorted for size and color



One of the many spotlessly clean breeding pens. Hens for breeding are selected carefully, and get a blood test three times each year—more often than many human beings get a physical check-up!



This giant incubator holds 32,000 eggs. The trays rest in a revolving cradle that is turned every four hours. Heated and humidified air circulates around the eggs, insuring ideal hatching conditions

... SCIENTIFIC POULTRY RANCH

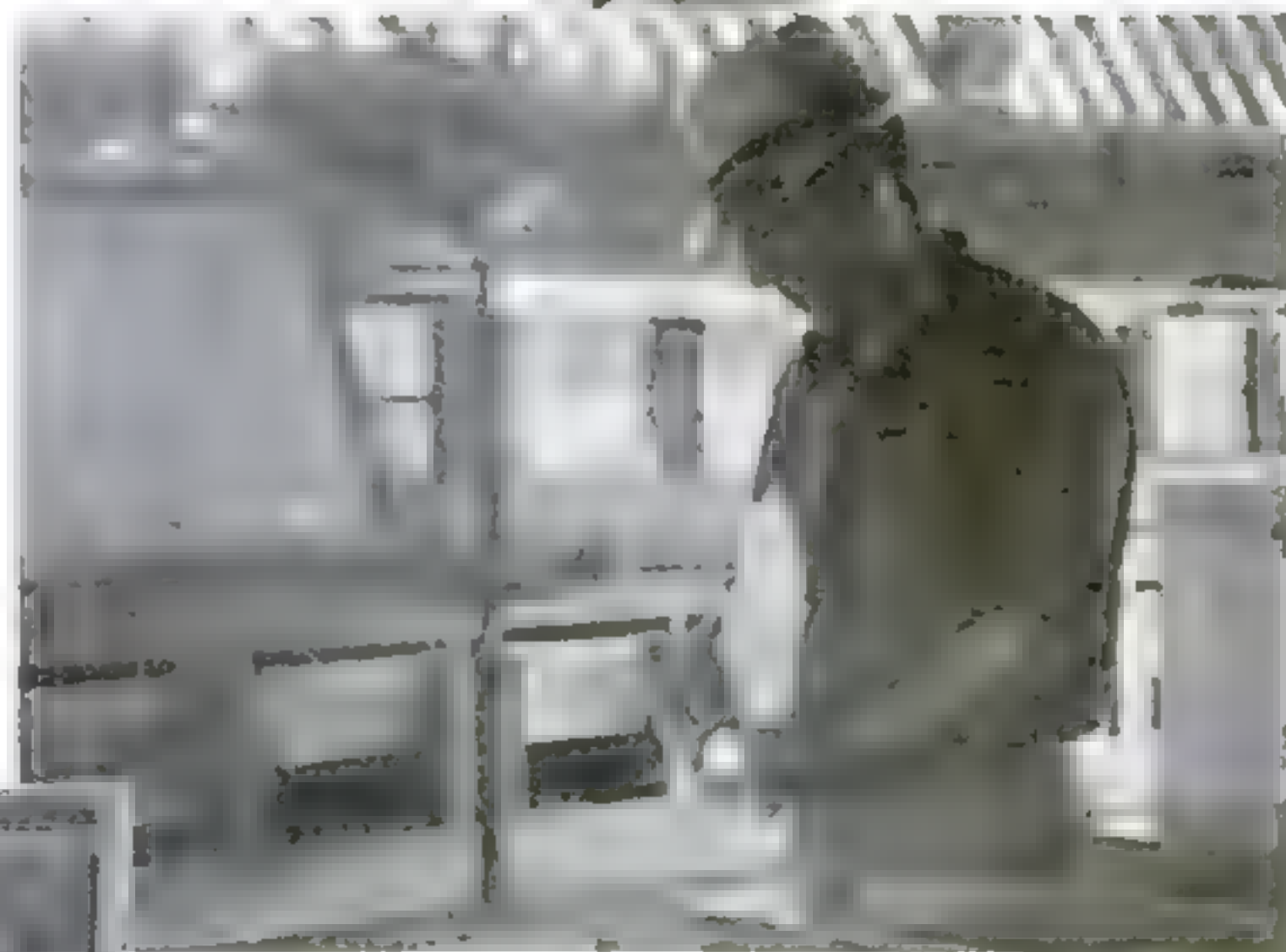
by the Clock

pens and later to the ranks of the egg producers. At every stage, they are subjected to rigid tests, and all except the fittest are ruthlessly weeded out. In the temperature-controlled indoor pens, artificial light insures a uniform laying day of fourteen hours the year around; a laying hen never sees the open sky from the day she is hatched until, her producing days over, she is sold for meat.

Equally painstaking is the care given the product of this ultramodern chicken farm. Eggs are light-tested, weighed, cleaned, sorted for size, packed, and shipped to market under an efficient routine that suggests the production line of an automobile factory.



All eggs must pass a light test as shown at the left. The base of the egg is placed against an opening from which a strong beam of light pours. This reveals any internal defect, such as the blood clot that appears as a black spot on the egg in the photograph below. Eggs that contain imperfections of any kind are thrown out



To check a hen's laying record, she is put in a trap nest, an individual coop with a sliding door. An inspector later removes the hen and counts the eggs found inside the nest



Just out of the incubators, these chicks are being examined for physical fitness. Any that do not show promise of growing into healthy fowls are painlessly disposed of with cyanide gas

Little chicks go to market. As a side line, some of the output of the incubators is sold to other poultrymen to be raised for eggs or meat. They are boxed carefully and shipped to purchasers in special streamline trucks

PRODUCES 130,000 EGGS A DAY



Patrol Car Warns of Marching Soldiers

WHEN the U. S. Army recently began mimic war maneuvers involving 56,000 men in western states and along the Pacific coast, precautions were taken to safeguard troops on

foot. Lest reckless drivers add real casualties to the imaginary ones inflicted in sham battles, scout cars patrolled the roads with warning signs for motorists.

Pet Duck Follows Child

A DUCK with a taste for sidewalk strolls amuses neighbors of Catherine Decker, of Bloomfield, N. J., by following its young mistress like the lamb of nursery jingles, as shown in the picture below.



Like Mary's little lamb, the duck trails behind



Bank's Deposit Chute Saves Customers' Time

TO SPARE patrons the inconvenience of waiting in line, a Tulsa, Okla., bank has installed an automatic depository. The user simply places indorsed checks and two deposit slips in a special envelope, and drops them into the slot of a receptacle resembling a mail chute. The falling envelope interrupts a beam of light trained upon an electric eye, ringing a bell to inform the patron that the deposit has been made, and drops into a vault in the basement. At regular intervals, bank employees remove the accumulated envelopes and credit the contents to the depositors' accounts, mailing them the duplicate deposit slips as receipts. The system is not intended for bills and coins.

Handy Tool Simplifies Tire-Chain Repairs



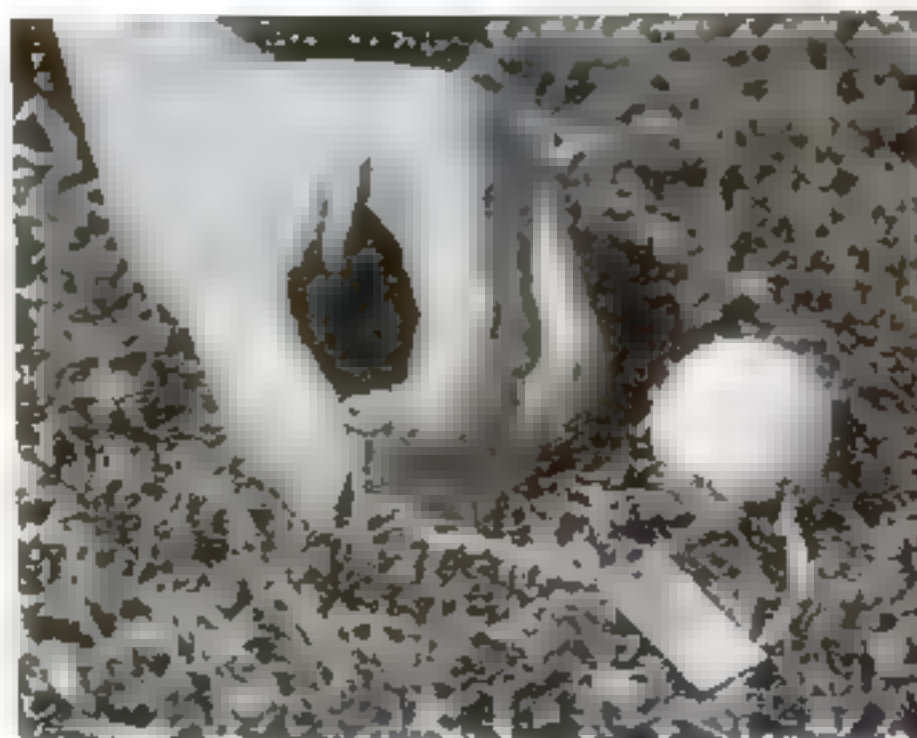
The jaws in use at the left open up a link. Those below are for closing it when the repair is made

Long handles and compound leverage make the chain tool easy to use



REPAIRING tire chains is made easy by a new double-duty tool. Spreader points are inserted in a link to be opened, and the powerful leverage of the long handles readily forces it apart. Another set of jaws closes the link securely after a new one has been added.

Novel Golf Tee Bends When Struck With Club



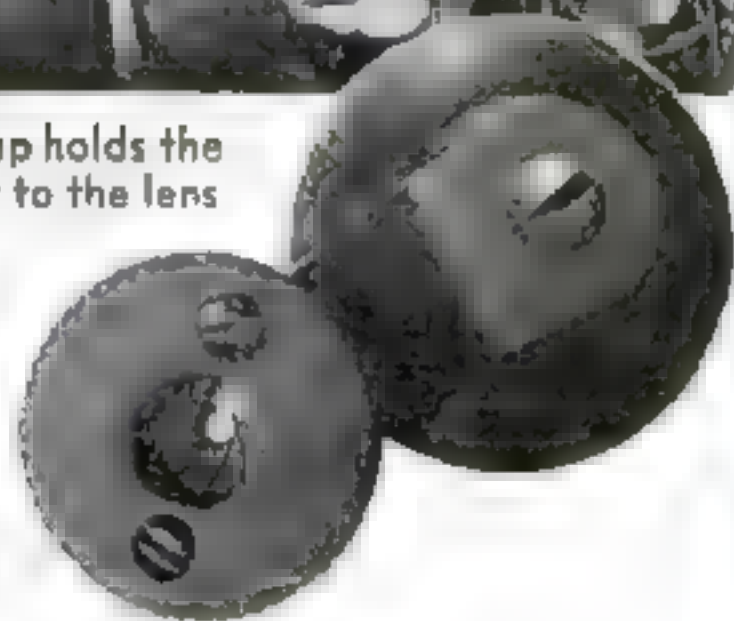
This golf tee is not damaged when a club hits it. A spring hinge allows the tip to bend



MADE of rustproof metal, a new golf tee has a hinged tip that bends when struck with a club so that the tee is not damaged or lost. A spring allows the tip to flex and then returns it to an erect position after the ball has been hit. A metal nameplate is attached to the device by a light chain to serve as a means of identification and provide further insurance against the tee's flying away.



A suction cup holds the attachment to the lens

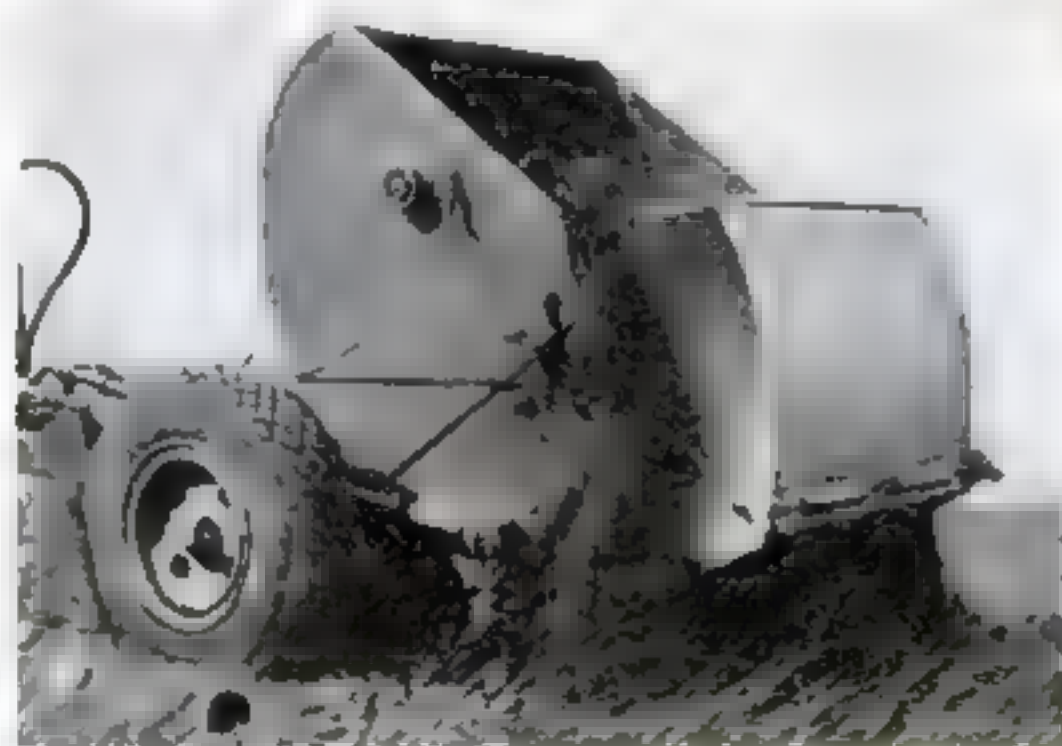


Novel Sighting Device Improves Shooters' Aim

TO AID hunters and target shooters in sighting a pistol or rifle, a small attachment for a pair of eyeglasses increases the depth of focus of the human eye, or its ability to perceive near and far objects distinctly at the same time. The result is to bring both the sights of the pistol and the target into clear vision. Resembling the iris diaphragm of a camera in appearance and principle, the device presents a pinhole aperture through which the user sights. This may be adjusted in size from two to fifteen one-hundredths of an inch, the smallest opening giving the greatest range of vision.

All-Purpose Scraper Carts and Dumps

WHEN a new, tractor-drawn scraper has taken a bite of soil, it becomes a pneumatic-tired wagon to carry the dirt away, and a dump cart to deposit it. The all-purpose implement can be used in all types of soil and will remove tree roots and other embedded material.



Carting a load of earth away on the scraper. The upper picture shows how the dirt is dumped

Racing Roosters Make 100-Yard Dash



When a door in front of the coops is raised, the cockerels race off to the end of the track

RACES for chickens have become a popular diversion at Gig Harbor, Wash. In the picture above, the coops have been opened at the signal of the start-

er's bell and a pair of three-month-old racing roosters are getting away to a fast start on their dash down the 100-yard track.

Interoffice Telephone Takes Up Little Room

COMBINING both receiver and transmitter in a single streamline unit, a new midget telephone for interoffice communication takes up little room on a desk. No bulky auxiliary equipment is required and any number of the units may be connected together, making the system particularly suited to large offices. A switch mounted in the base changes the midget telephone from receiver to transmitter.



Transmitter and receiver are combined in this phone for interoffice communication

Coat Rack Folds for Storing

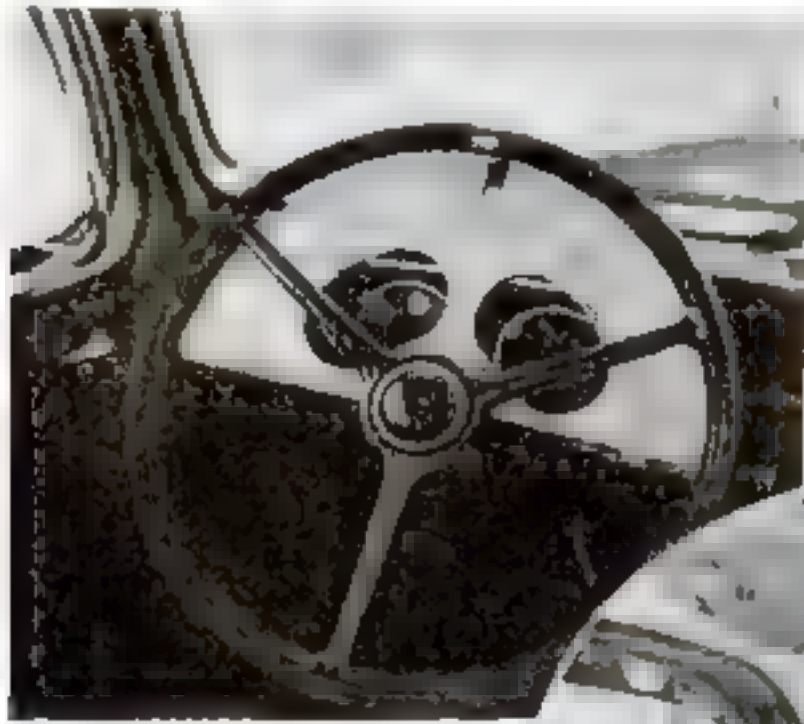
WHEREVER closet space is at a premium, in auto trailers, camps, and cottages, a compact new clothes rack comes to the rescue. Eight hooks, arranged in a cluster, provide ample room for clothes or coat hangers. When it is not in use, the handy closet accessory can be conveniently folded flat and stored in a small space.



Its eight hooks make the hanger ample for many garments

Mobile Laboratories Help Modernize Highways

SURVEYING old roads that need to be modernized for present day car speeds, by eliminating "blind curves" and other trouble spots, two test cars of California's Department of Public Works travel 1,000 feet apart. When a turn or dip conceals the machines from each other, the leading car stops. The second then measures to the hundredth of a mile the distance at which the lead car can be sighted. Ingenious instruments also show the grade of hills and the radius and bank of curves, important factors in highway safety.



Is a curve too sharp? A steering-wheel pointer tells the driver any curve's radius

A U-shaped tube of glass containing thin oil measures grades of roads. One like it on dashboard shows driver amount of road's bank



Top to bottom: Survey cars measure the grade of a hill; visibility over crest of a hill; visibility on a curve, and radius and bank of a curve

Human Test Tubes Aid Hay-Fever Research



These two volunteers are exposing themselves to ragweed pollen

SERVING as human test tubes, research workers in a Detroit, Mich., laboratory are deliberately contracting hay fever to develop cures for sufferers. Natural hay-fever victims make difficult subjects for study. In the laboratory, however, a volunteer may be given a specific type of hay fever, aiding discovery of a cure for that particular variety. The experimenters are shown at left being inoculated in tests.

Musical Novelty Has One String

BY STRETCHING a single string between the ends of a stick, a North Carolina inventor has provided himself with a strange musical instrument. To play it, he places one end of the stick between his teeth, twangs the string, and varies the tone with his mouth, eliciting music like that of a jew's-harp but with greater variety and volume.



The musician's mouth is the sound box of this instrument



Wooden Cats on Sign Deceive Scrappy Pup

SOME CATS may be made of wood—but to one dog at least, they're still fair game. The picture above pays tribute to the realism of a decorative street sign at Bay Ridge, Md., as a terrier climbs for his supposed quarry perched on the sign.

Tractor Helps Wreck Building



Pushing debris over the side of the building, the tractor speeded demolition work

HOISTED to the top of a seven-story San Francisco building, a powerful tractor recently helped wreckers make short work of tear-

ing down the structure. After a crane had knocked the walls to pieces, the tractor pushed the debris over the side of the building.

New Speedometer Dial Shows Braking Range

ATTACHED to a car's regular speedometer, a new dial shows not only the vehicle's speed but also the corresponding number of car lengths in which the driver can stop in case of emergency. By helping him to visualize the limitations of his brakes, the circular chart is intended to aid him in driving safely and to discourage him from taking chances.



The safety dial fits a regular speedometer

Two views of the flight analyzer for use on planes



Recorder Logs Flight

FLIGHT ANALYZERS installed on passenger planes of a leading American air line will record the craft's altitude during flight, the amount of time a "gyro" or automatic pilot is in use, and the number and time of radio reports to the ground. In case of a crash, the records may help shed light on the cause.

This strange tower was erected for a joke 200 years ago



Spire Built To Win a Bet

STANDING in a field at Darlington, England, a strange conical tower is a relic of an eighteenth-century hoax. John Fuller, a farmer, bet the village parson that the church spire could be seen from Fuller's house in spite of an intervening hill. Before the cleric's next call, Fuller had the fake spire built in a near-by field and his visitor, unable to doubt his own eyes, was fooled into paying the wager.

Motorized Trailer Pushes Bicycle

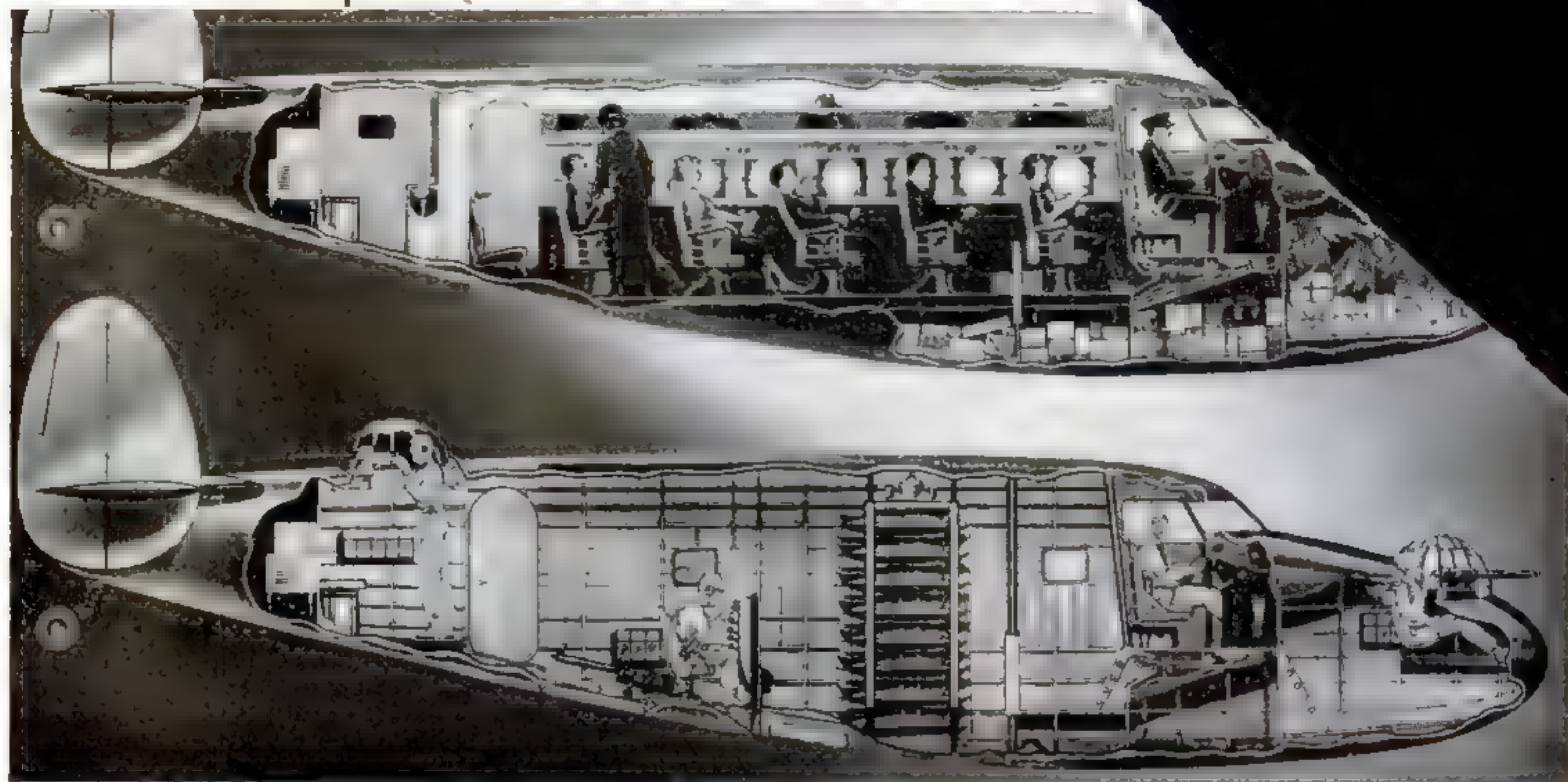
AN ITINERANT knife grinder has devised a "cart-before-the-horse" rig to ease his labors on long-distance bicycle journeys. When he tires of

pulling his trailer, with its motor-driven grinding machinery, he hitches the motor to the wheels and the trailer pushes him.



Trailer carrying knife-grinding equipment. On hills, the gasoline engine pushes the bike

New Transport Plane Can Be Converted

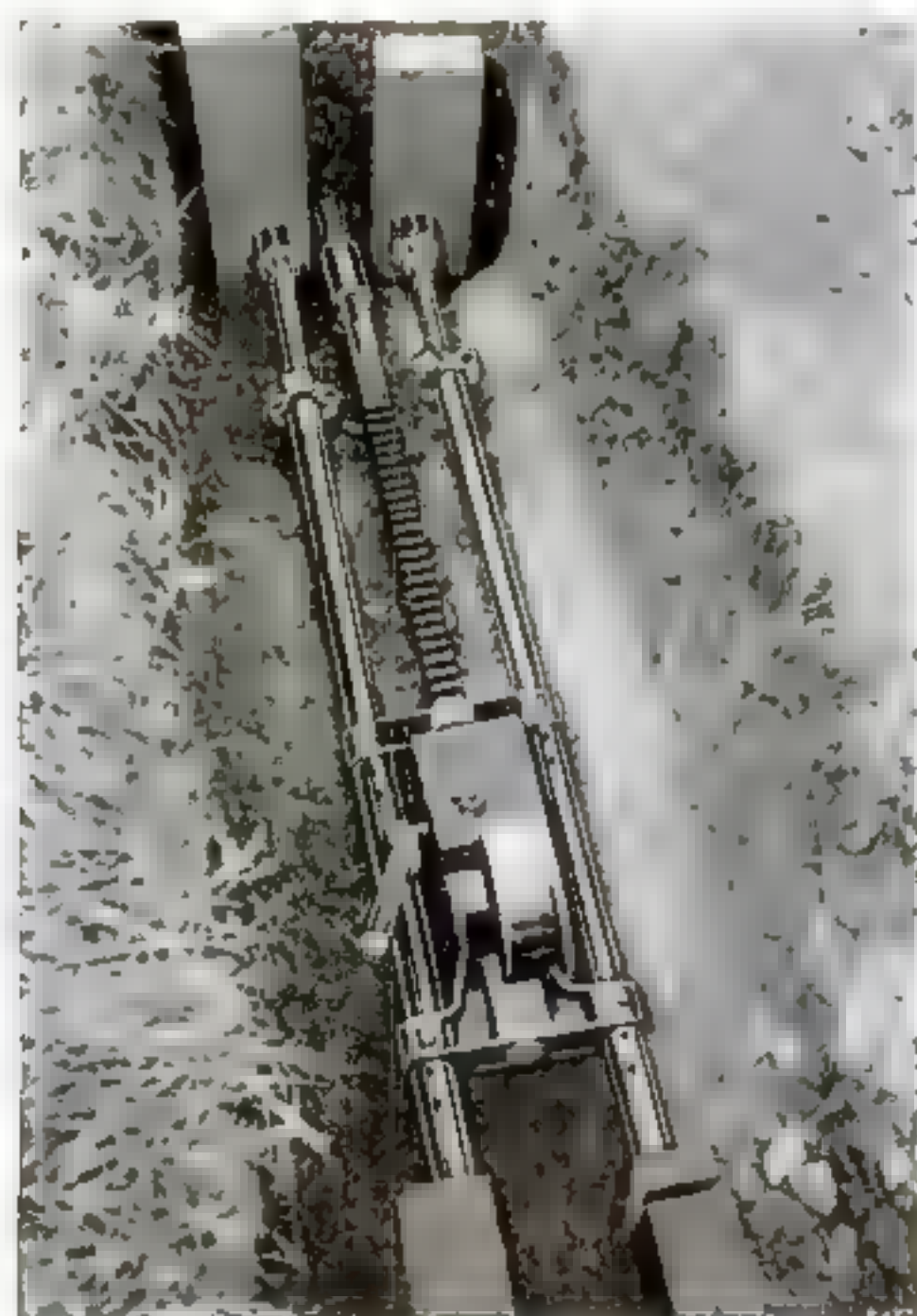


How the addition of bomb racks and machine-gun turrets transforms the new airliner into a powerful bombardment unit for use in wartime

THOUGH intended for peaceful service, a high-speed passenger plane designed for an American air line may quickly be converted into a bomber in

time of national emergency. Normally the ship carries eleven passengers and a cabin attendant. As a war plane, its four-man crew includes two machine

gunners, one of whom doubles as co-pilot, and a bombardier. The machine has a top speed of 260 miles an hour and a 2,000-mile cruising range.



Hand Jack Lays Pipe Without Ditching

CAPABLE of pushing pipe sixty feet or more through the ground, a new hand-operated jack makes it possible to lay branch pipe lines without digging trenches and tearing up lawns and pavements. Braced in a pit as shown above, the jack first drives a pointed-capped, three-foot section of pipe in the proper direction. Additional sections are attached and the operation is repeated until the pipe emerges in a pit at the other end.

Transparent Visor Replaces Flyer's Goggles

A TRANSPARENT visor that covers the entire face, attached to an aviation helmet of new design, takes the place of goggles and gives unrestricted visibility. When not needed, it may be swung out of the way. The photograph at right shows the device in use by Valentine Wigram, seventeen-year-old British flyer, receiving congratulations on qualifying for a pilot's license.

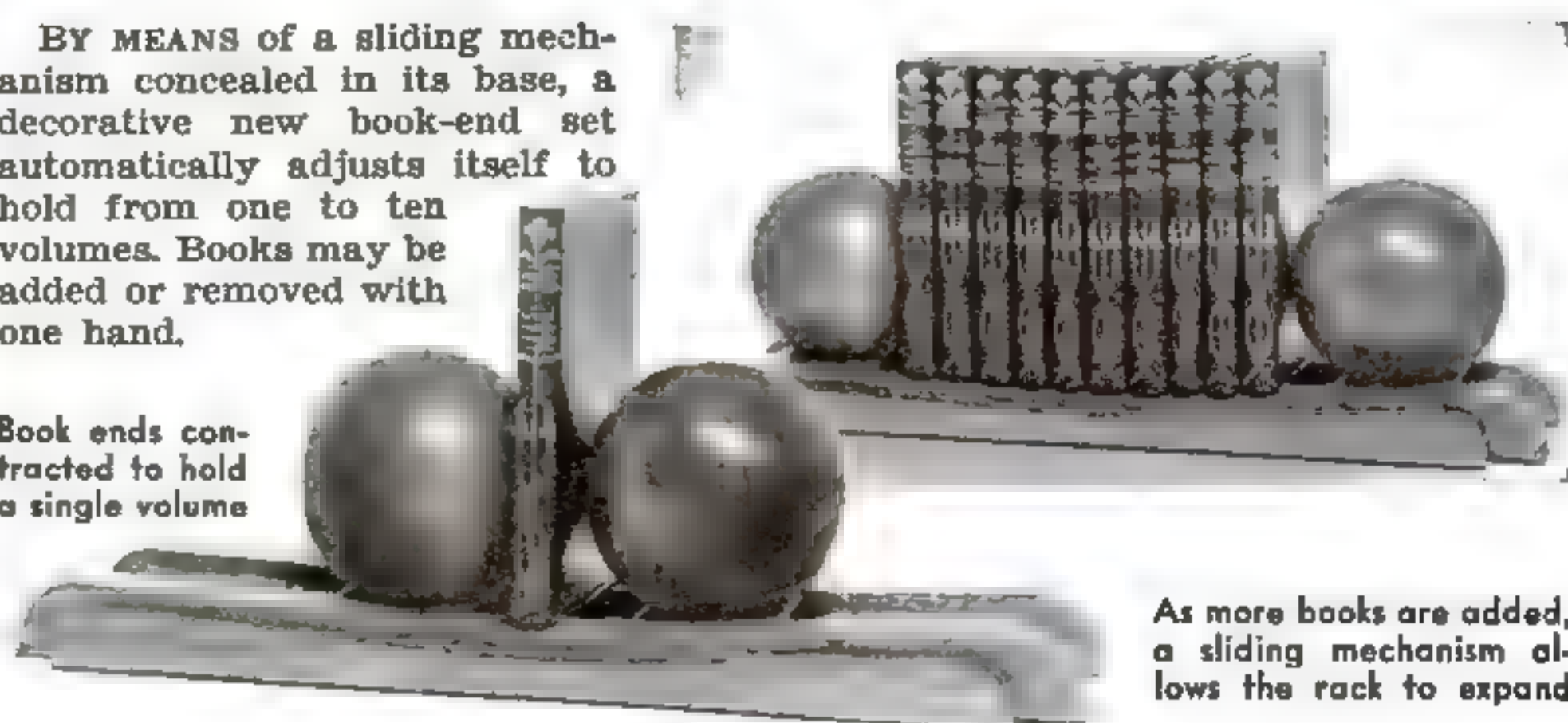


Valentine Wigram, British boy pilot, wearing a new-type flying helmet

Book Ends Adjust Themselves Automatically

BY MEANS of a sliding mechanism concealed in its base, a decorative new book-end set automatically adjusts itself to hold from one to ten volumes. Books may be added or removed with one hand.

Book ends contracted to hold a single volume



As more books are added, a sliding mechanism allows the rack to expand

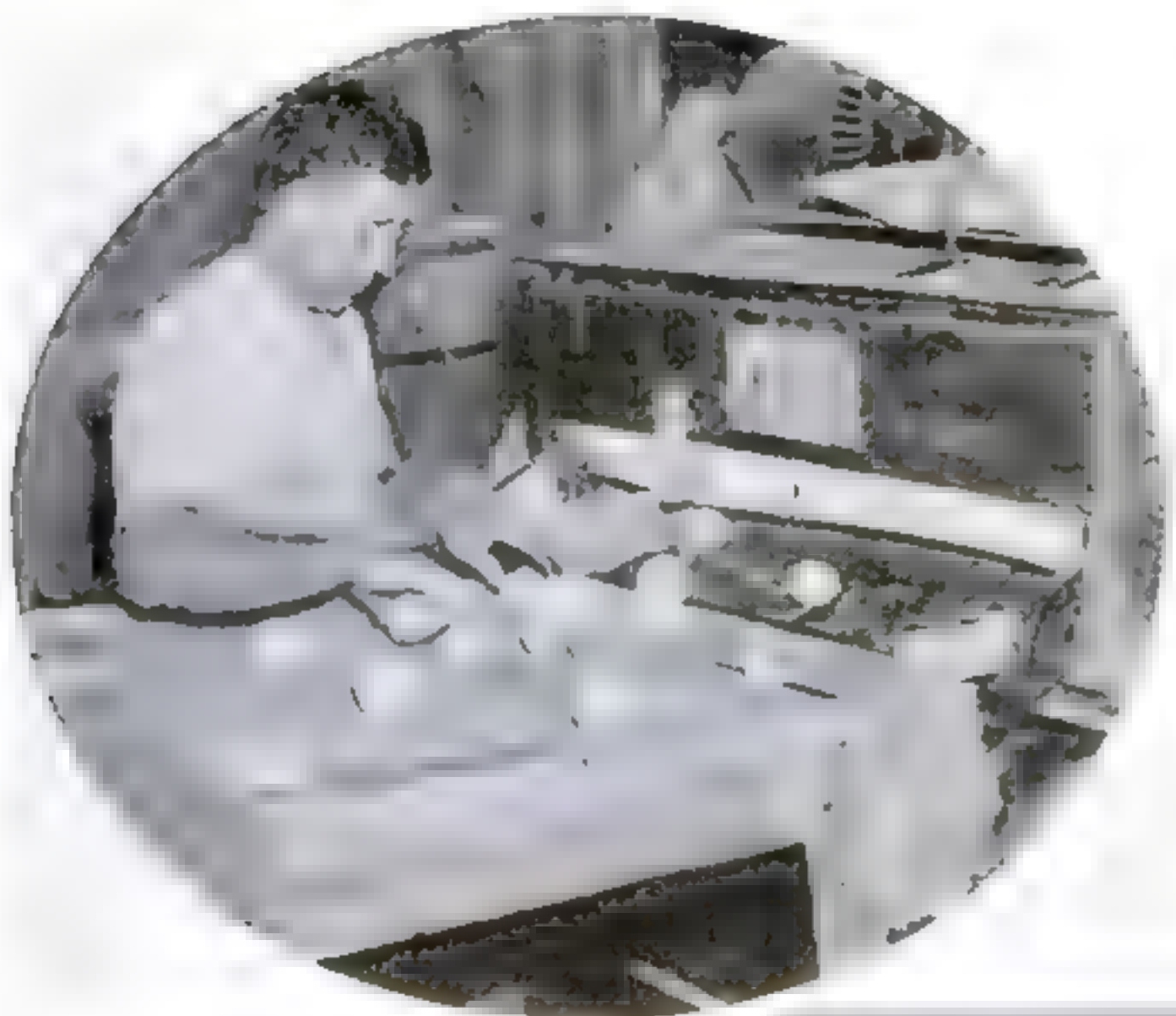


Man Beats Horse in Hurdle Race

WHICH is faster over the 120-yard hurdles, a man or a horse? To decide the question, a bizarre race was held recently at Fort Oglethorpe, Ga. T. G. Towns, Olympic hurdler, was one contestant and Tommy Roberts, one of the

fastest jumping horses in the U. S. Cavalry, was the other. Although the horse was required to clear only half as many hurdles as the man, the latter won the race by a margin of six inches.

Peach Shaver Removes Fuzz



FUZZLESS peaches have been placed on the market by a Richwood, N. J., fruit grower. He has designed a special machine which "shaves" the fruit before it is offered for sale. Endless belts carry the peaches between moving brushes that strip away the soft, hair-like fibers and leave the fruit with a smooth outer surface. The fuzz is dropped into baskets and the treated fruit is packed according to size for shipment.

New Device Tests Oil for Carbon

TO TEST various lubricating oils for carbon, a new laboratory apparatus employs a superheated metal disk containing four cup-like depressions. The disk is heated electrically to approximately the temperature of the piston head of a running automobile engine. Then, drops of oil of four different grades fall slowly into the depressions. When the test is completed, the amount of carbon residue in the four depressions is compared.



Indians Reënact Odd Ancient Rope Dance

WHIRLING downward around a fifty-foot pole at the ends of unwinding ropes, a half dozen Indians from Mexico recently brought the "flying pole dance," an ancient Aztec religious rite, to a spectacular close at a Chicago, Ill., festival. Representing mythical characters, the six performers

climbed to the top of the pole, danced on a revolving platform, and then, with ropes fastened to their ankles, swung out head first, whirling in widening circles as the ropes unwound, as shown in the photograph above.



Last Stand of the

**FUTURE ADMIRALS OF EIGHTEEN LANDS
LEARN THEIR TRADE BEFORE THE MAST
ON SURVIVORS OF CLIPPER-SHIP DAYS**

BEATING their way across the seven seas, more than thirty big windjammers are fighting the sailing ship's last desperate battle for existence. Lined up in the imagination, they form an amazing fleet. Cargo-carrying sailers, built in the nineties, run side by side with magnificent auxiliary-powered steel ships scarcely half a dozen years old, and fitted with the navigating equipment of a modern transatlantic liner. The latter are the seagoing school ships and nautical colleges in which hundreds of young men are being trained as officers in the naval and merchant-marine services of eighteen countries of the world.

As a ship of war, the sailing vessel gave way completely to the steamer before the turn of the century. As a commercial carrier, she has fought a longer, but ever-losing fight.

With the passing of the dozen or so big windjammers that still battle an easterly passage around Cape Horn each year, carrying grain from Australia to England—and disaster and scrapping are taking one or two a year—*finis* will be written to the glorious history of the sailing ship as a cargo carrier. However, as a training school for the men who may later command great modern liners and warships, she still valiantly holds her own.

That sail training is not to be abandoned without a stiff struggle is indicated by the very newness of many of the vessels in the training fleet. One of the finest vessels, the auxiliary-powered *Almirante Saldanha*, the 3,400-ton training ship of the Brazilian Navy, was built in British shipyards just three years ago. The new *Georg Stage*, smart little full-rigged ship built by the Danes to replace an older vessel of the same name, first saw service in 1935. Nine others of the fleet—Japanese, German, Danish, Norwegian, Italian, Belgian, Greek—are less than ten years old.

In numbers, the Germans lead the world with five ships. Three of these, the *Deutschland*, *Grossherzogin Elisabeth*, and the *Gorch Fock*, are sponsored by the government and by training-ship societies. The other two, the big four-masted barks *Commodore Johnsen* and *L'Avenir*, have just been acquired by the North German Lloyd and the Hamburg-American lines, for training future mates and masters of the *Bremen*, *Europa*, and other great German liners. So thoroughly are they convinced of the value of training in sail, that both these companies require a boy to serve

In this country, four states maintain merchant-marine training ships for future skippers



Finnish naval cadets man the rigging of the training vessel "Soutman Joutsen" for their first sight of America as the ship enters a port of call on a practice cruise

By
**KENNETH
M.
SWEZEY**



The "Deutschland," one of several school ships on which young men are trained as officers in the German Navy and merchant marine



Windjammers

three years on a sailing ship before he is permitted to enter a school for higher theoretical training and steamship handling.

Perhaps the most beautiful and remarkable ships of the world's fleet are the *Cristoforo Colombo* and the *Amerigo Vespucci*, training ships of the Italian Navy. Heavily rigged, and with two broad white bands painted on their black hulls to represent gun decks, they might easily be mistaken for ghosts of seventy-four-gun ships of the line, of a century ago. Further investigation, however, discloses that they are modern steel ships, built in 1928 and 1931, respectively, and that when the wind fails they may speed along at a good rate under the power of the most up-to-date Diesel-electric propelling machinery!

The smallest and oldest sailing school ship in present use is the little Norwegian brig *Statsraad Erichsen*, of 119 gross tons, owned by the Oslo Training Ship Institution. Largest of the training ships, and the second largest sailing ship ever built, was the ill-fated *København*, five-masted steel vessel with auxiliary engines, built just after the World War by the Danish East Asiatic Company. Carrying a crew of sixty-seven men, including forty-five cadets, this splendid 4,000-ton wind ship left Buenos Aires, Argentina, on December 14, 1928, bound round Cape Horn for Melbourne, Australia. For months, anxious relatives and company officials awaited further word. In the nine years since, no clew to her fate has been found. The name of the *København* was written on the long list of mysterious tragedies of the sea.

Although many ships of the training fleet have powerful auxiliary engines, and carry enough fuel for cruising under power for thousands of miles, commanders pride themselves on logging as much of the total voyage as possible under sail, reserving their engines for calms, unfavorable winds, heavy



Almost driven from the seven seas as a cargo carrier, the sailing ship still hangs on as a floating academy for men who will command in steam



weather, and maneuvering in congested waters. Cadet officers learn to set and trim sail, brace the yards, and handle their ship generally, as deftly as crack seamen of the clipper era.

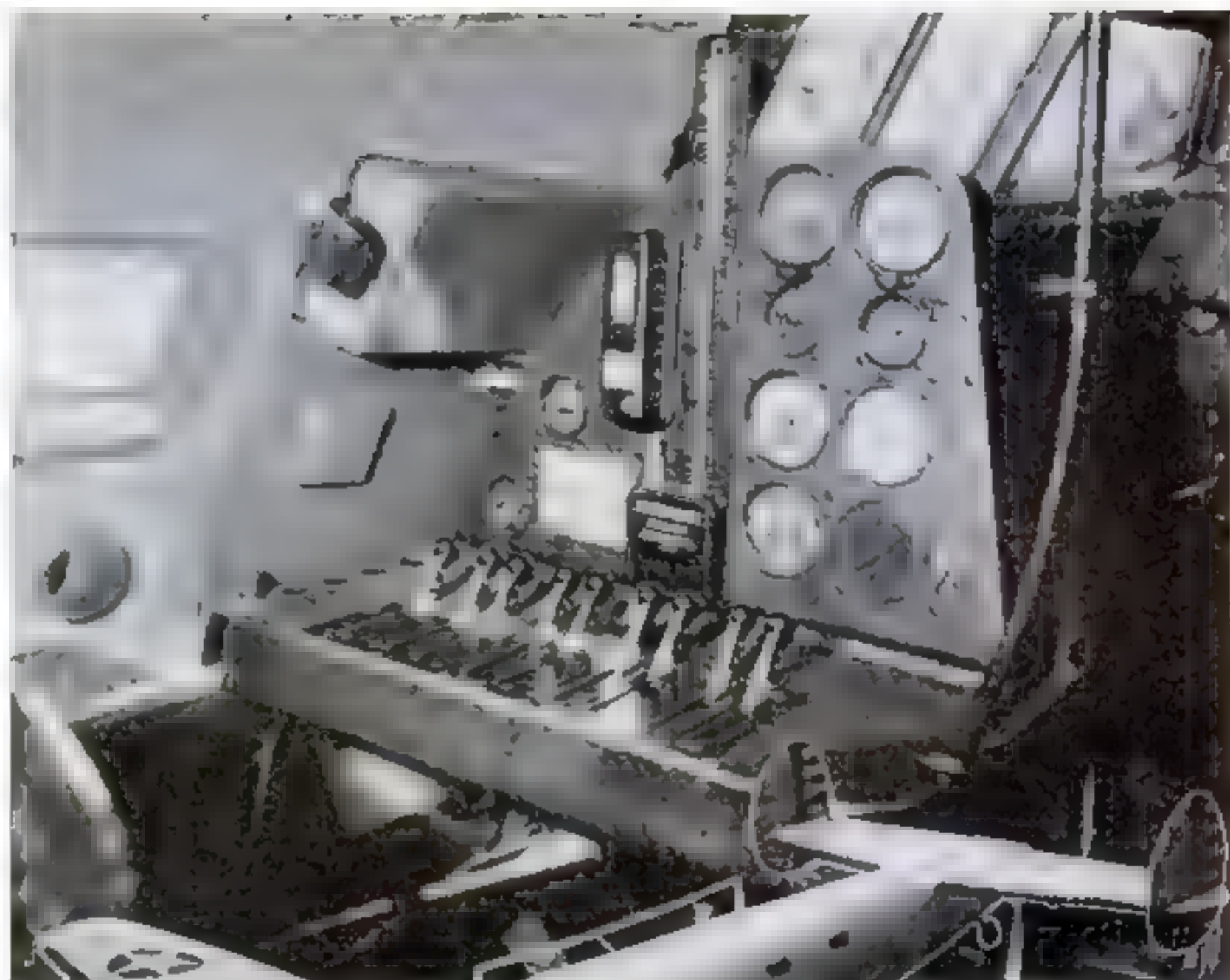
An example of the excellence of Japanese training in sail handling took place off the coast of California not long ago. One of Japan's newest training vessels, the four-masted *Nippon Maru*, had just crossed the Pacific, from Tokyo to Ensenada, Mexico, a distance of 5,300 miles, in forty-three days. Hearing of this, newspaper and newsreel men of San Diego, Calif., radioed the captain, expressing their desire to photograph his ship under full sail. The captain agreed to cooperate.

At nine o'clock on the appointed morning, his magnificent bark lay at anchor in San Diego (*Continued on page 130*)

Tiny Bike Is Nine Inches High

SCOOTING through the streets of London, England, on a vehicle resembling an oversize roller skate, a cyclist recently demonstrated the sturdiness of what he called the world's smallest bicycle. A spill would be nothing for the tiniest of tots to worry about, for the seventeen-inch-long midget machine stands only nine inches from the ground. It weighs only five pounds.

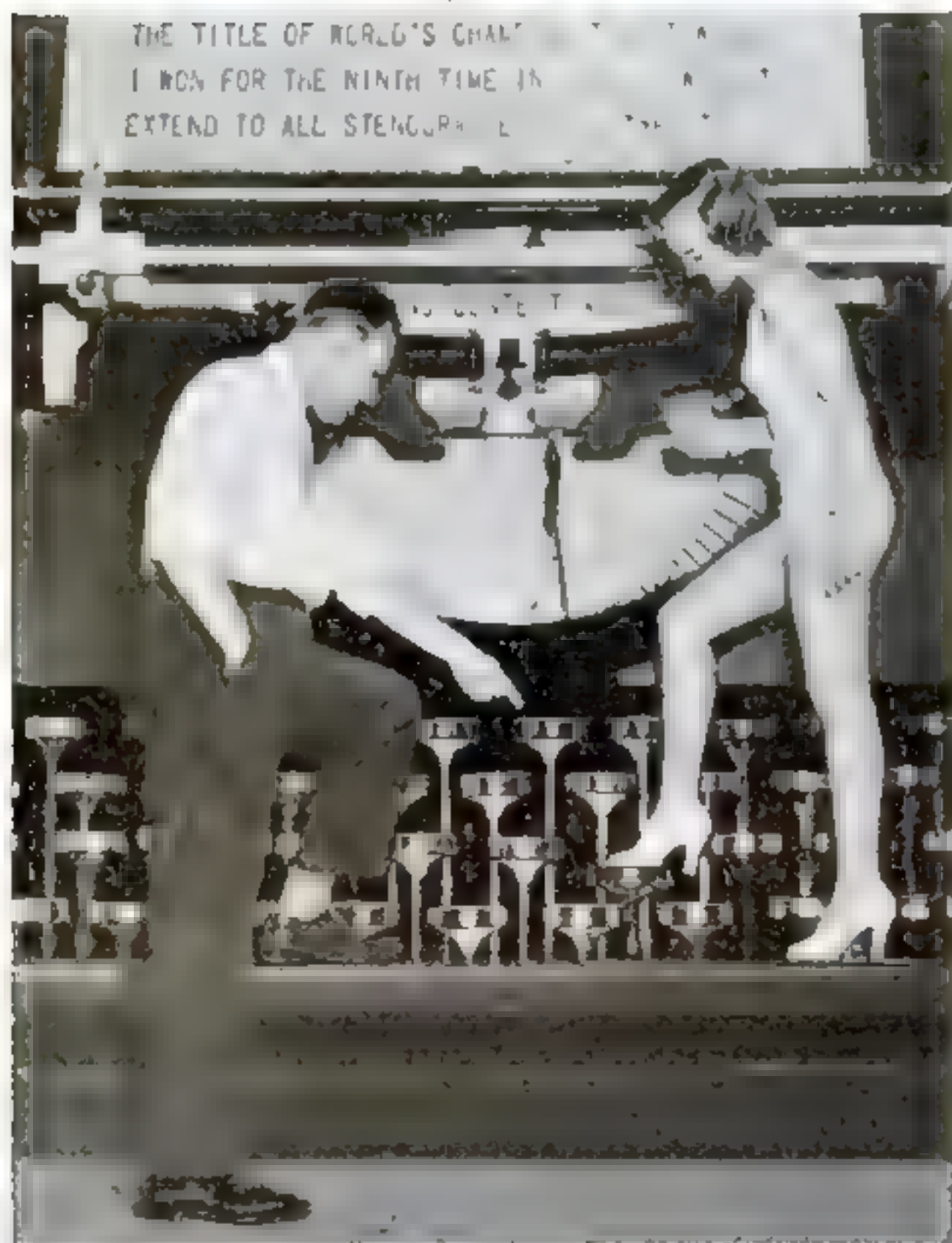
At least, this cyclist hasn't far to fall from his midget wheel



Pressure-control apparatus in new sub-stratosphere plane, seen in air at left

U. S. Army Tests Altitude Plane

AERIAL BATTLES miles above the earth, at heights that few aeronauts had reached only a few years ago, are foreshadowed by a sub-stratosphere plane placed under test by the U. S. Army Air Corps. During flights through the rarefied upper air, special apparatus maintains an artificial sea-level atmosphere in the air-tight reinforced cabin so that the occupants can breathe naturally.



Huge Typewriter Really Works

SO HUGE that its keys must be operated with the feet, a mammoth typewriter has been placed on exhibition at Atlantic City, N. J. One of its giant type bars is seen about to strike, above, as a champion typist dictates a challenge to rivals.

Match Books Get Foolproof Cover

BY MAKING it impossible to strike a match without closing the cover, a new safety-match packet prevents possible burns from ignition of the remaining matches. To withdraw a match, the user turns the pivoted cover sideways, barring access to the striking surface until the cover is pushed back into place, shielding the others.

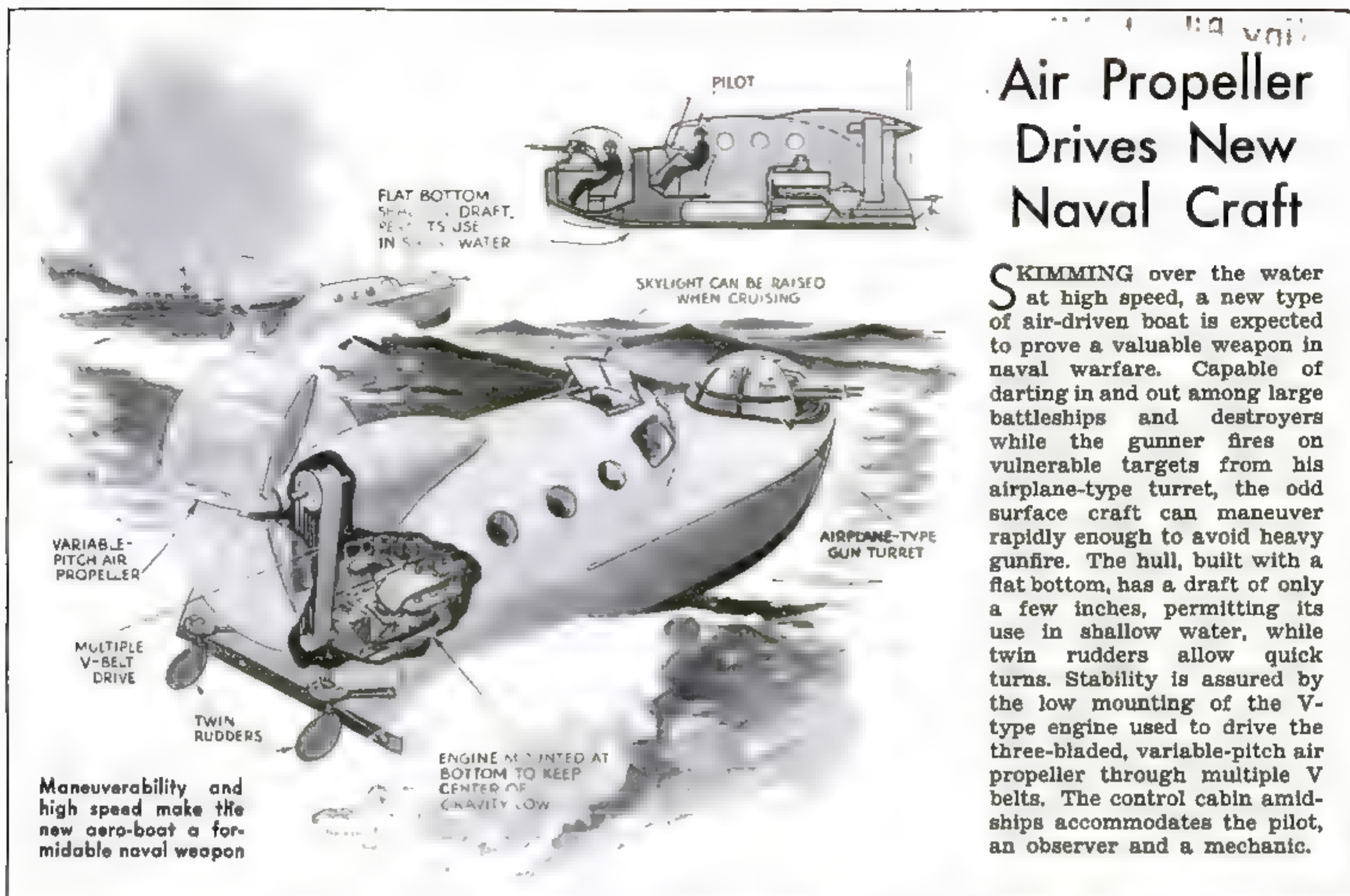


The match cannot be struck until the cover has been replaced



Death Chamber for Dogs Is Built into Truck

A DEATH CHAMBER for dogs is a feature of a truck operated by the Animal Protective Association of Washington, D. C. Incurably sick or injured animals are placed in the compartment and destroyed by carbon monoxide gas.



Air Propeller Drives New Naval Craft

SKIMMING over the water at high speed, a new type of air-driven boat is expected to prove a valuable weapon in naval warfare. Capable of darting in and out among large battleships and destroyers while the gunner fires on vulnerable targets from his airplane-type turret, the odd surface craft can maneuver rapidly enough to avoid heavy gunfire. The hull, built with a flat bottom, has a draft of only a few inches, permitting its use in shallow water, while twin rudders allow quick turns. Stability is assured by the low mounting of the V-type engine used to drive the three-bladed, variable-pitch air propeller through multiple V belts. The control cabin amidships accommodates the pilot, an observer and a mechanic.

Hay-Fever Mask Is Electric



POLLEN that causes hay fever is said to be removed from the air by a new electric mask to be worn by sufferers from the complaint. Electrified intake screens powered by a small built-in battery serve to attract dust and pollen particles in the air and keep them out of the nose.

Electrically charged screens filter out the air's dust and pollen

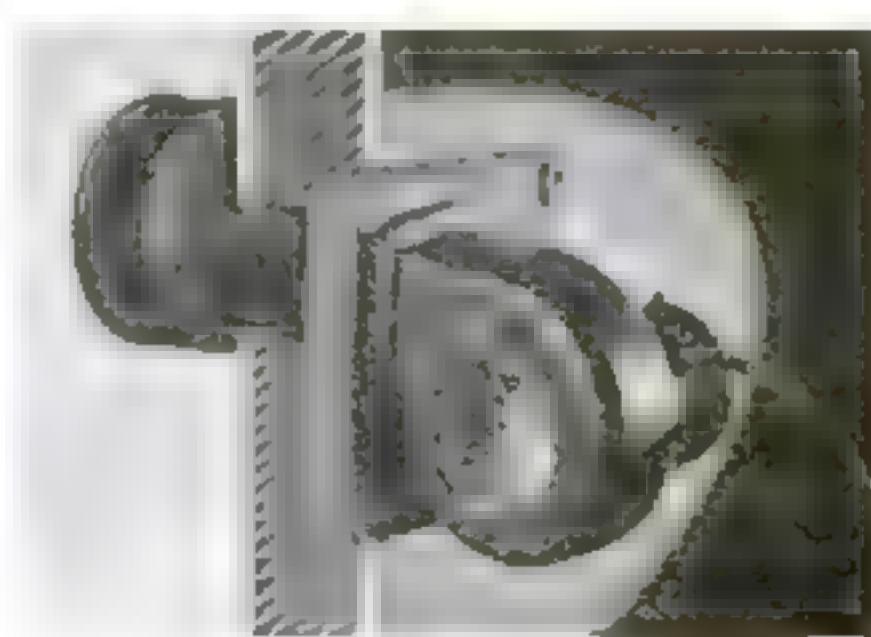
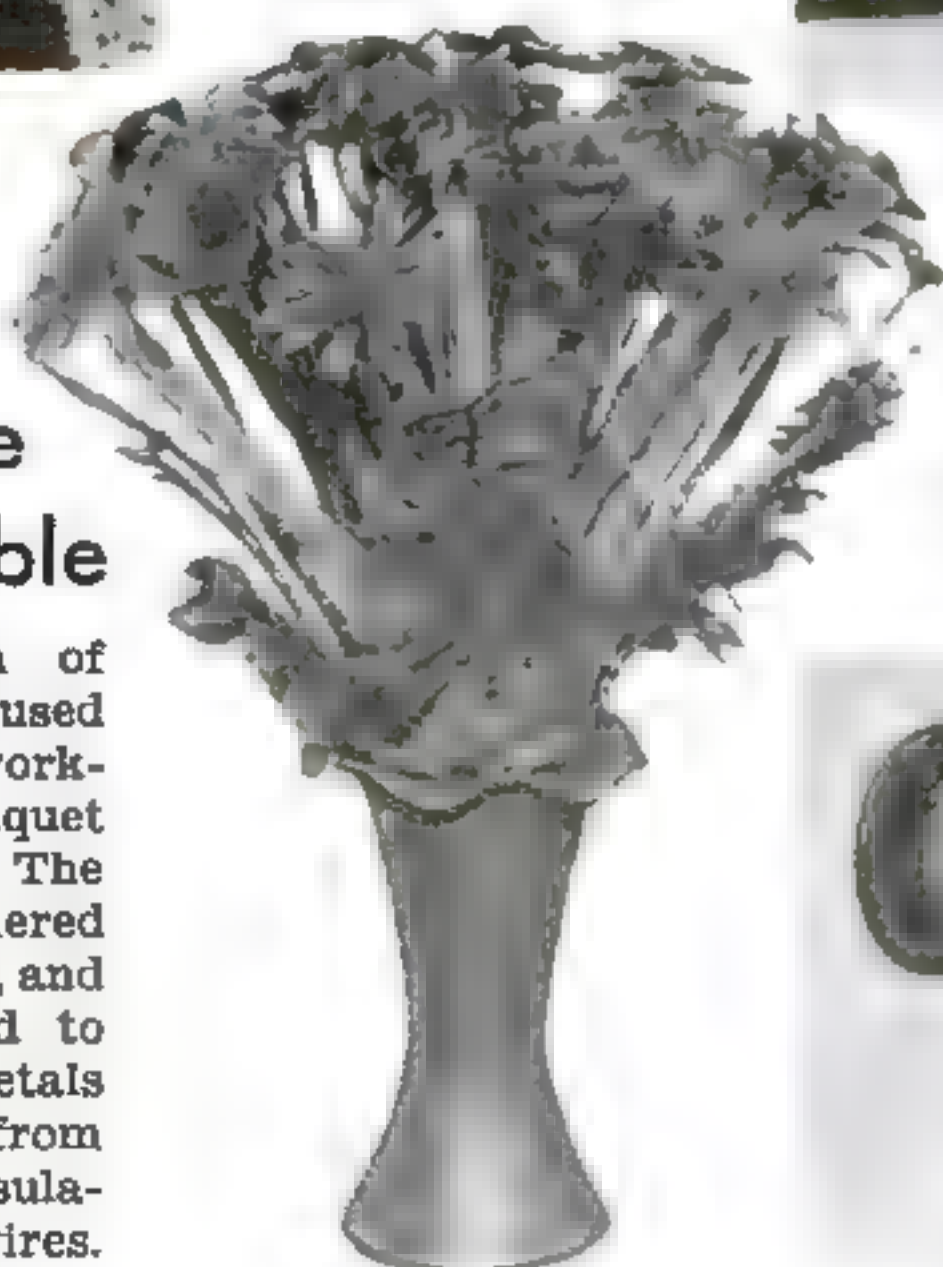


Hostesses Go to School in Plane Cabin

CABINS of giant transport planes now serve as classrooms for training air-line hostesses. Taught the mechanical details of the planes as well as their regular duties, the flying hostesses go through an intensive three-week course before they are assigned to regular flights. The photograph above shows a blackboard demonstration of a plane's heating system.

Bouquet Made from Phone Cable

A DISCARDED length of telephone cable was used by a retired telephone worker to make the odd bouquet shown at the right. The lead sheath was hammered into the form of a vase, and the wires were spread to simulate plant stems. Petals and leaves were formed from the colored-paper insulation on the individual wires.



Blower Ventilates Photo Darkroom

FRESH air for the amateur photographer's darkroom is supplied by an inexpensive electric blower just marketed. A built-in trap prevents light from entering through the vent, while rubber mountings insure quiet operation.



City Skyline Decorates Dress

A PANORAMA of the skyline of Chicago, Ill., printed on the hem, decorates the unusual dress shown in the photograph. According to its designer, the odd costume may set a new style of geographical gowns, women wearing the skylines of their home cities.

Hornlike Cannon Summons Villagers

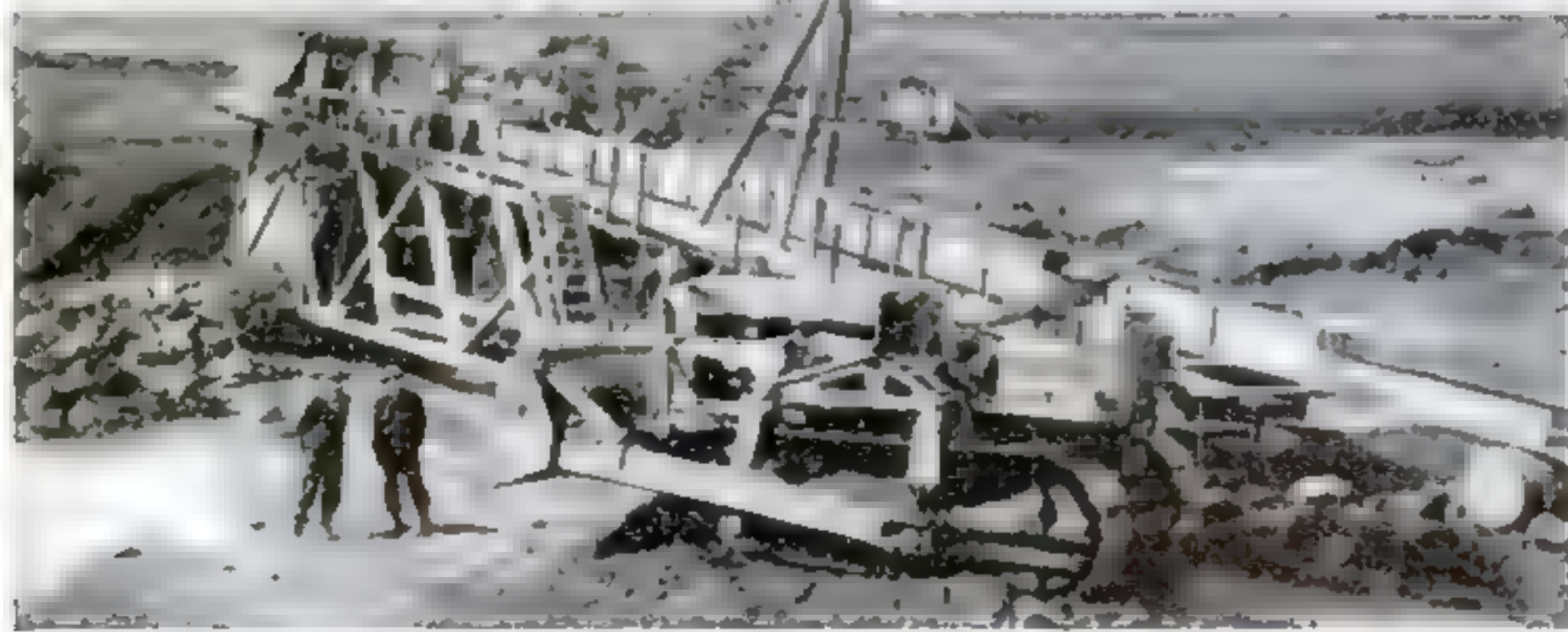
A DEAFENING roar from the odd, cone-shaped cannon shown below summons natives of the surrounding villages in the Austrian Alps to important occasions. The unique piece of artillery has a special barrel, shaped like a big megaphone and built up from sections of heavy sheet metal, the joints being riveted together. The unusual, wide-muzzle design was adopted in order to produce the loudest possible sound from a moderate charge of powder.



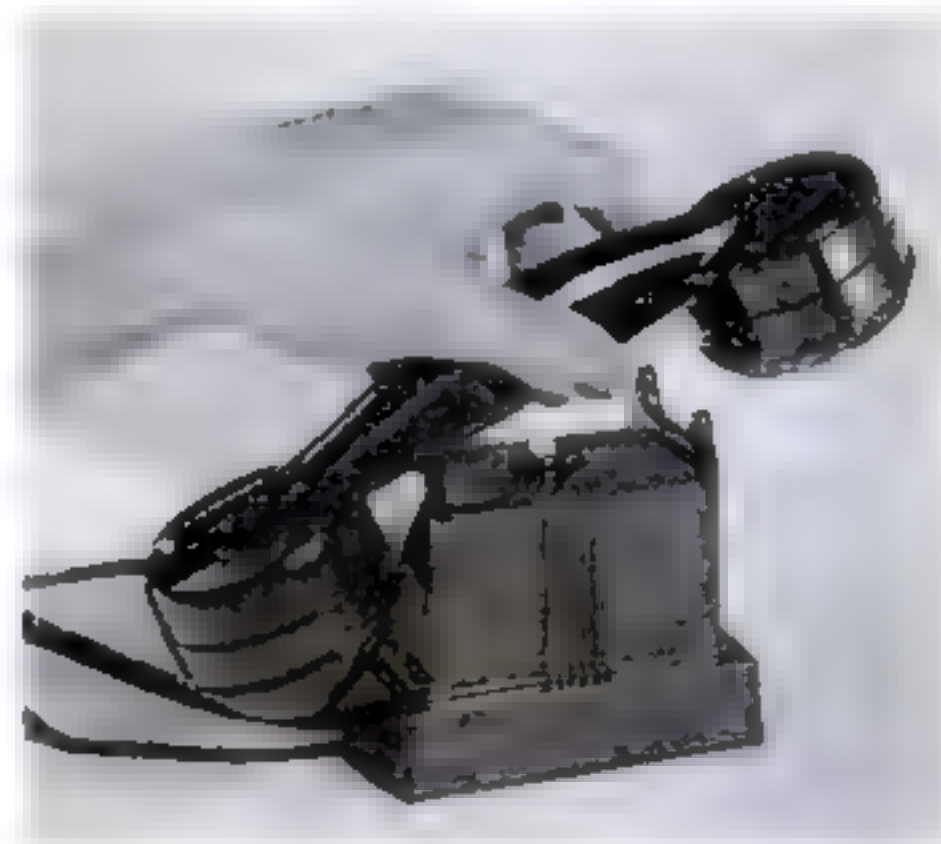
In use, the odd signal cannon is set up on a hillside overlooking the villages

Platinum Mines Create New American Klondike

PLATINUM, Alaska, named after the metal it produces, is the scene of America's newest and richest "gold rush." Although it boasts only fifteen houses, fifteen tents, a general store and post office, and one hotel, more than \$1,000,000 worth of machinery has been set up to wrest the precious metal from the earth. Located in an isolated section called Good News Bay, Platinum's only contact with the outside world is by radio and the few planes that bring in the necessary supplies.



The town's post office, above, and a typical platinum mine operated by placer methods



Handy Telephone Set Needs No Switchboard

RESEMBLING the conventional hand-set telephone, a newly introduced, battery-operated communication system requires no central switchboard. Calls may be made to other telephones on the line simply by pressing a signal button on the base. No outside source of current is needed, the electrical supply being obtained from a six-volt storage battery or four dry cells.

Hot Water Runs Engine

HOT WATER, issuing from the earth at 185 degrees, Fahrenheit, will be used to run a new engine recently developed in Russia. Utilizing the difference in temperature between the water and the surrounding air, the motor is designed to deliver 100 horsepower.



Novel Mechanical Accordion Plays from Music Rolls

OPERATED by electricity, a mechanical accordion just introduced uses perforated paper rolls in the manner of a player piano. Air passing through the holes in the paper opens valves to produce the notes of a melody. In the photograph above, the new instrument is seen on display beside an animated mannikin which seems to be playing a conventional hand-operated accordion, while the music really comes from the cabinet.

Collecting Fishing Tackle Is Odd Hobby



J. Charles Seaman and part of his fishing-tackle museum

EVERY day for thirty years, J. Charles Seaman of Cleveland, Ohio, could go fishing with a different plug, spinner, or fly—and never have to buy any new equipment. Experts call his collection of fishing tackle the most valuable privately-owned one in existence. Even the walls of his home have had to be pressed into service to accommodate his thousands of trophies, which his wife, a convert to his unusual hobby, helps him arrange and classify.

Mrs. Seaman shares her husband's unusual hobby

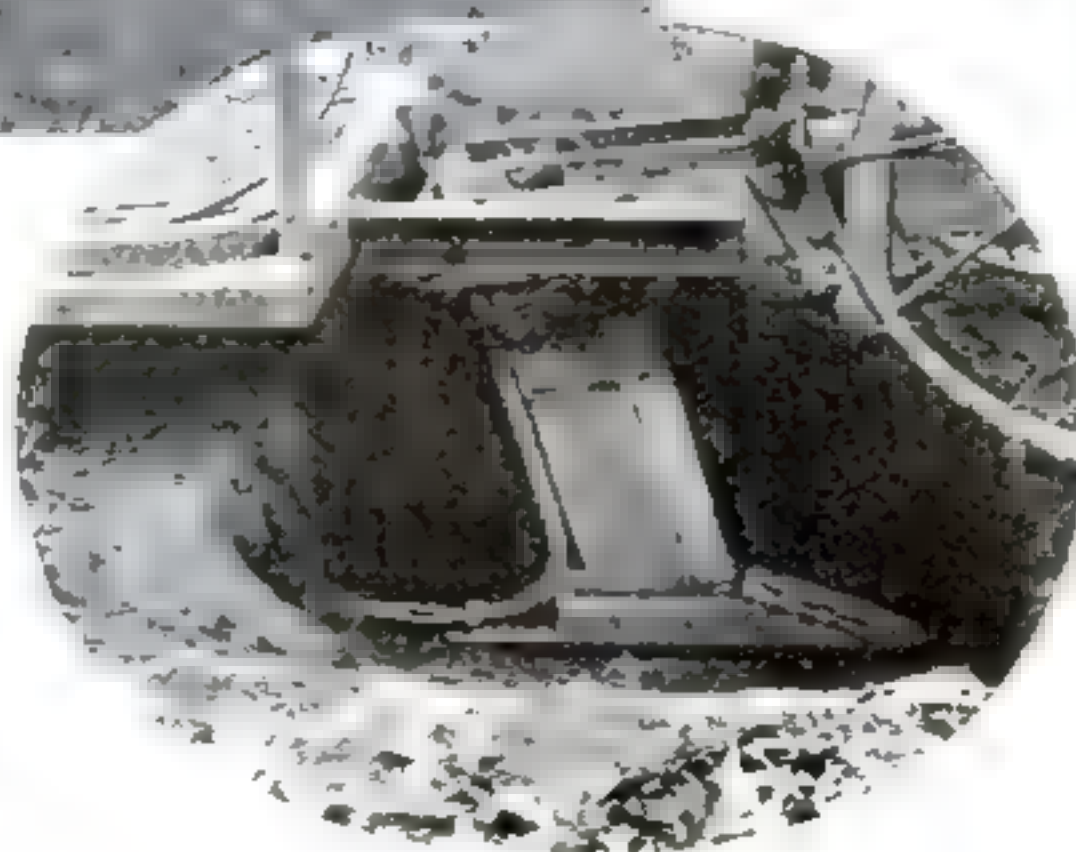
Plow Buries Underground Telephone Cables



Cable-laying plow at work. It makes a narrow trench that seals itself

Wires are fed out through a tube at the back edge of the plow blade, as pictured below

BURYING telephone cables underground in a single operation is the work of a special plow developed recently by Bell Telephone Laboratories engineers. Towed by a tractor, the machine has a narrow vertical blade with a tube at its back edge, through which the cable is fed from reels mounted on the carriage. Adjustable for depth, the blade makes only a narrow slit in the soil, which closes itself automatically.



Air Filter for Trucks Has Large Capacity

DESIGNED for use on truck motors, a new-type carburetor air filter is said to be able to collect as much as four pounds of dust without becoming clogged. Surfaces bathed with a spray of ordinary crankcase oil trap dirt and grit which would damage working parts and impair the efficiency of the engine.

The shrimp fleet heads for the open sea. Averaging about thirty-five feet long, the vessels are powered by gasoline or Diesel engines and have sleeping accommodations for their crews on long trips



Shrimp Fishing-

A \$3,000,000 INDUSTRY

By Germaine Kellermann

DRAGGING huge, funnel-shaped nets across the floor of the Atlantic Ocean and the Gulf of Mexico, tiny fishing vessels scoop up millions of bushels of shrimps each year to meet the demands of epicures in this country and abroad. Rating high among the food-fishery industries, shrimping gives employment to thousands of persons and yields a \$3,000,000 annual return to the fishermen themselves.

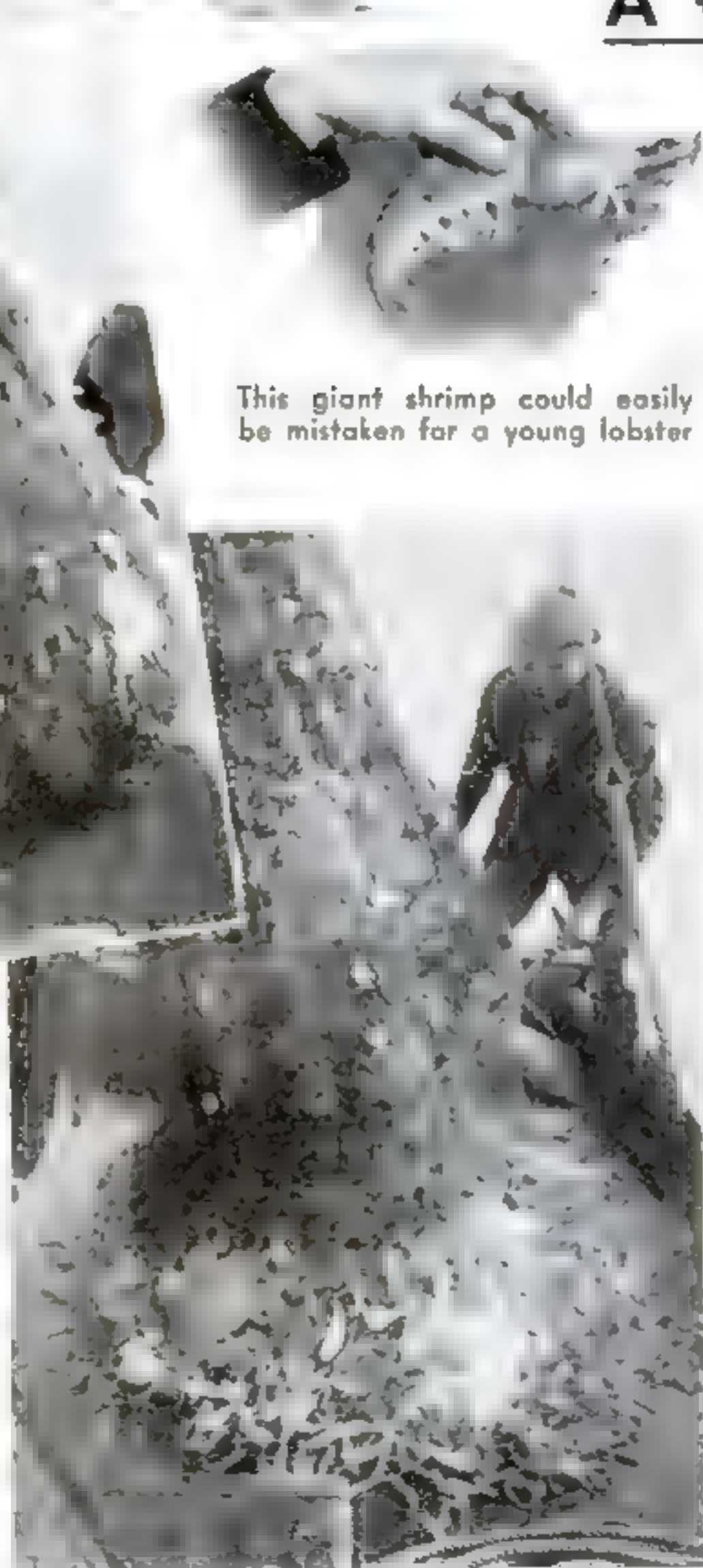
Shrimps like moderately warm water, and migrate with the seasons. For this reason, many of the fishing boats have sleeping quarters for their small crews so that they can follow the prawn, ranging as far north as the South Carolina coast in the summer, working off Florida and the Gulf states in the spring and fall, and going farther south in the winter.

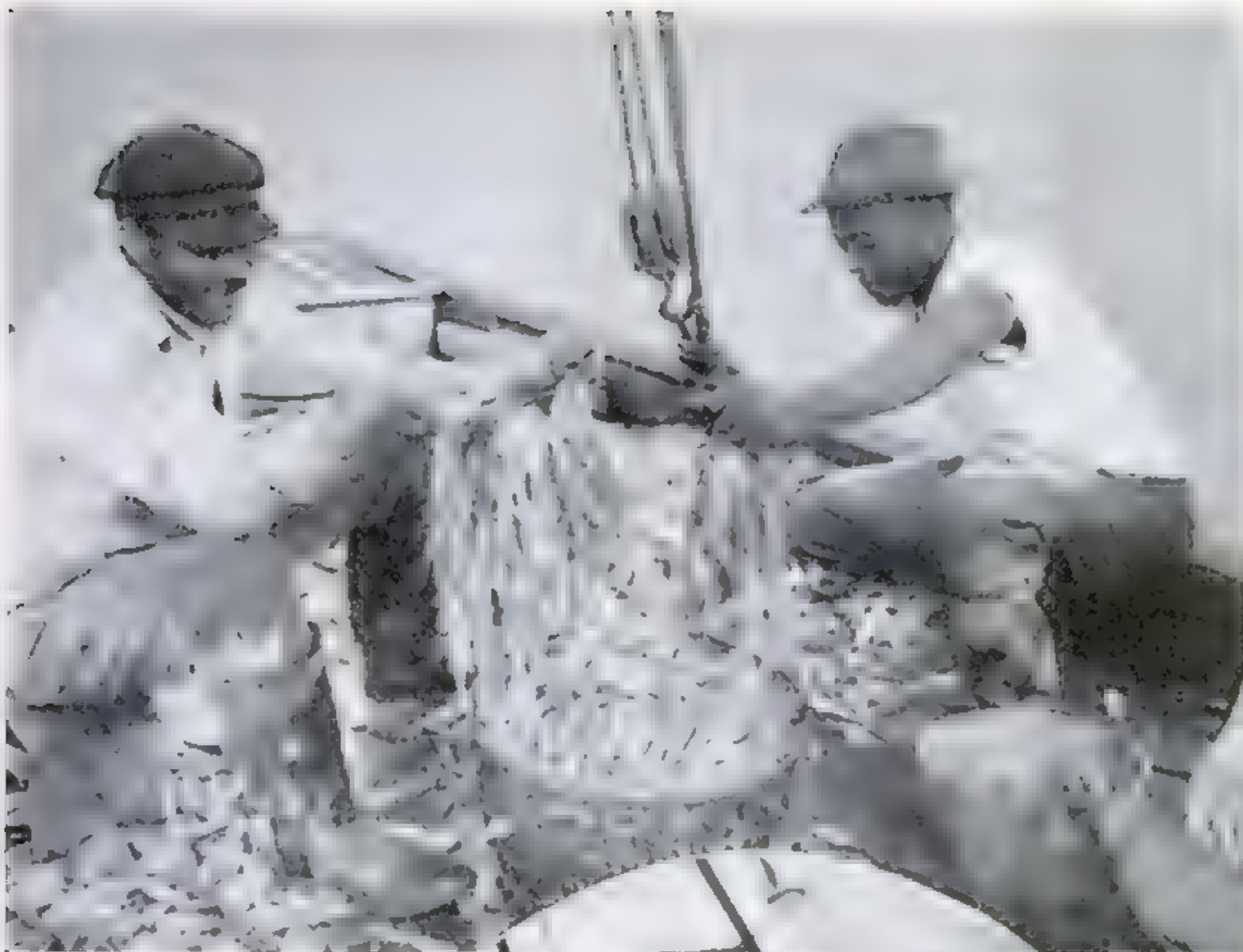
Best shrimping is found on mud bottom, sometimes five miles or more from shore. Fishermen locate good spots by means of a sounding lead that has a cavity filled with fat, which brings up samples of the bottom. The sixty-foot net is paid out and "trawled," or dragged along the sea floor, for hours at a time. A weighted bag at the end of the funnel catches the shrimps. When the net is raised, this bag is pulled aboard and a draw string at its lower end dumps the catch on the deck. Eight or ten hauls may be made in a day, with a total catch as high as 200 bushels.

Back at the unloading docks, the skipper sells the catch to a dealer and divides the proceeds with his helpers. Most of the shrimps go to the cannery, where they are shelled, cooked, and packed neatly in glass jars as you find them at your neighborhood store.

This giant shrimp could easily be mistaken for a young lobster

At the fishing grounds a sixty-foot, funnel-shaped net is lowered and dragged along the ocean bottom. After about two hours of this trawling, it is hoisted to the surface and the weighted bag at its lower end is swung aboard the boat, as seen above. Pulling a draw string at the bottom of the bag dumps the catch, sending a cascade of silvery shrimps pouring across the tiny deck





Helpers measuring a haul of shrimps before storing them in the hold of the boat. When fishing is good, a day's work—eight or ten drags with the net—will yield 200 bushels. The catch is sold to a dealer at the unloading docks, and the proceeds are divided between the skipper and helpers

For canning, shrimps are headed and shelled by hand. After washing, they are boiled for twelve minutes and graded for size before being packed neatly in glass jars as seen in the picture below



On the way home, the small fish that have been caught in the net are shoveled overboard. This is a treat for the sea gulls, which swarm around the boat for a meal



Back in the home port, the shrimp boats present an odd appearance with their nets looped up on the booms like sails. Hundreds of vessels are engaged in this picturesque and profitable work



This grading machine at the cannery sorts shrimps by sizes as they pass through holes in a shaking conveyor. The larger sizes, called "jumbos," are highly prized and bring comparatively good prices



Yacht's Tender Serves as Fire Boat

FIRE-FIGHTING equipment installed in the tender of his yacht by a Chicago sportsman is intended to aid fellow yachtsmen and boat owners in case of a blaze. A pump connected to the launch's engine throws a 200-foot stream to put out fires, and also can be used to pump water from a leaky vessel's hull.



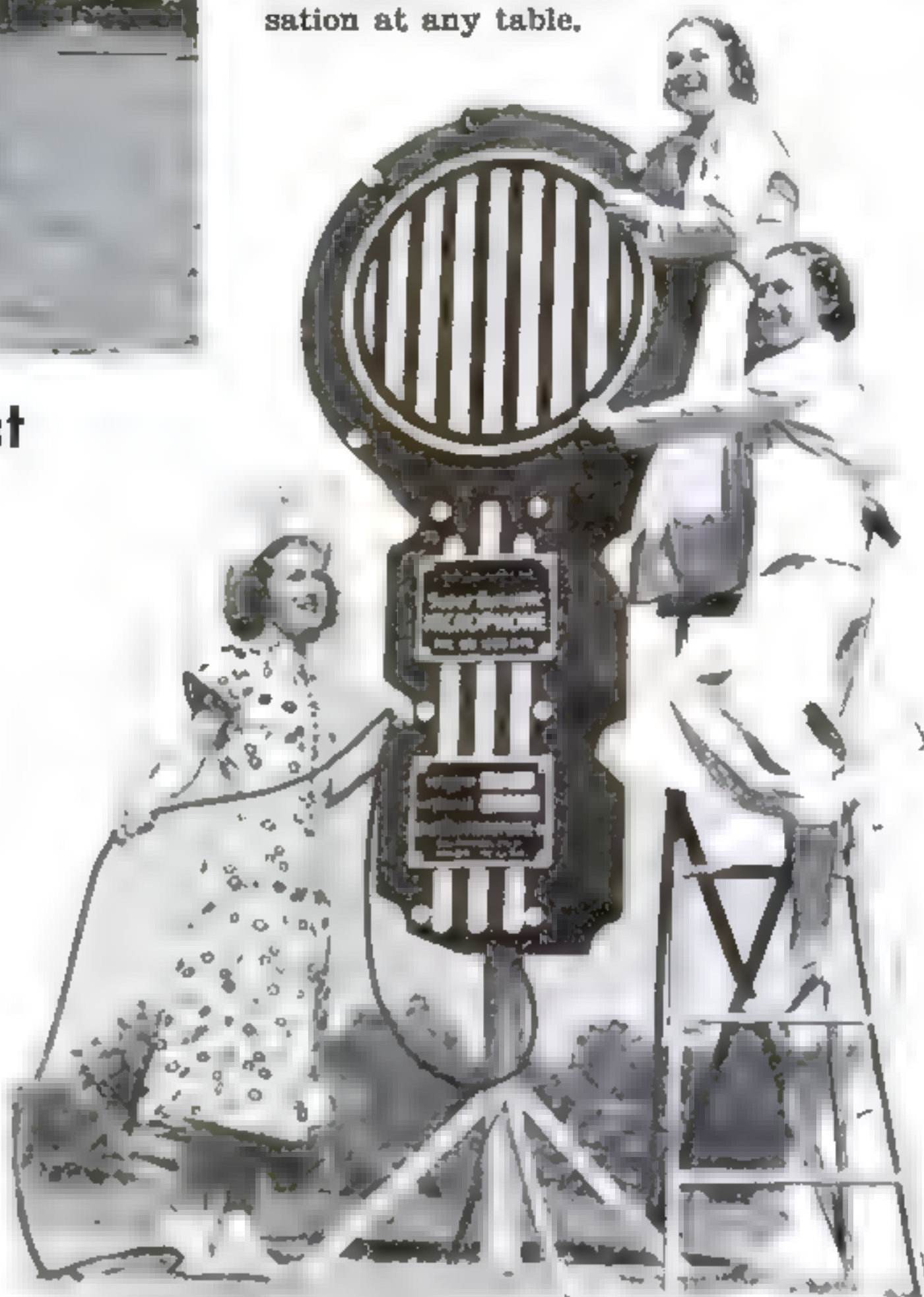
A receptacle in the base of the mug holds a cylinder of dry ice

Odd Refrigerator Stein Keeps Beer Cool

DRY ICE cools the contents of a new type of beer stein. Made with a cylindrical compartment extending up through its center, the mug can be fitted with a special plug that holds a piece of solidified carbon dioxide. As the dry ice evaporates, the cold gas passes over the walls of the false bottom and chills the beer. The device is said to keep the beer cool and fresh even if it stands as long as an hour.

Giant Mike Reports Bridge Tournament

Towering more than ten feet in the air, the giant microphone shown below was installed recently in California for use during a bridge tournament in which more than 1,000 players participated. The huge pick-up unit could be focused to catch the conversation at any table.



This mammoth microphone can be focused to catch sounds at any point



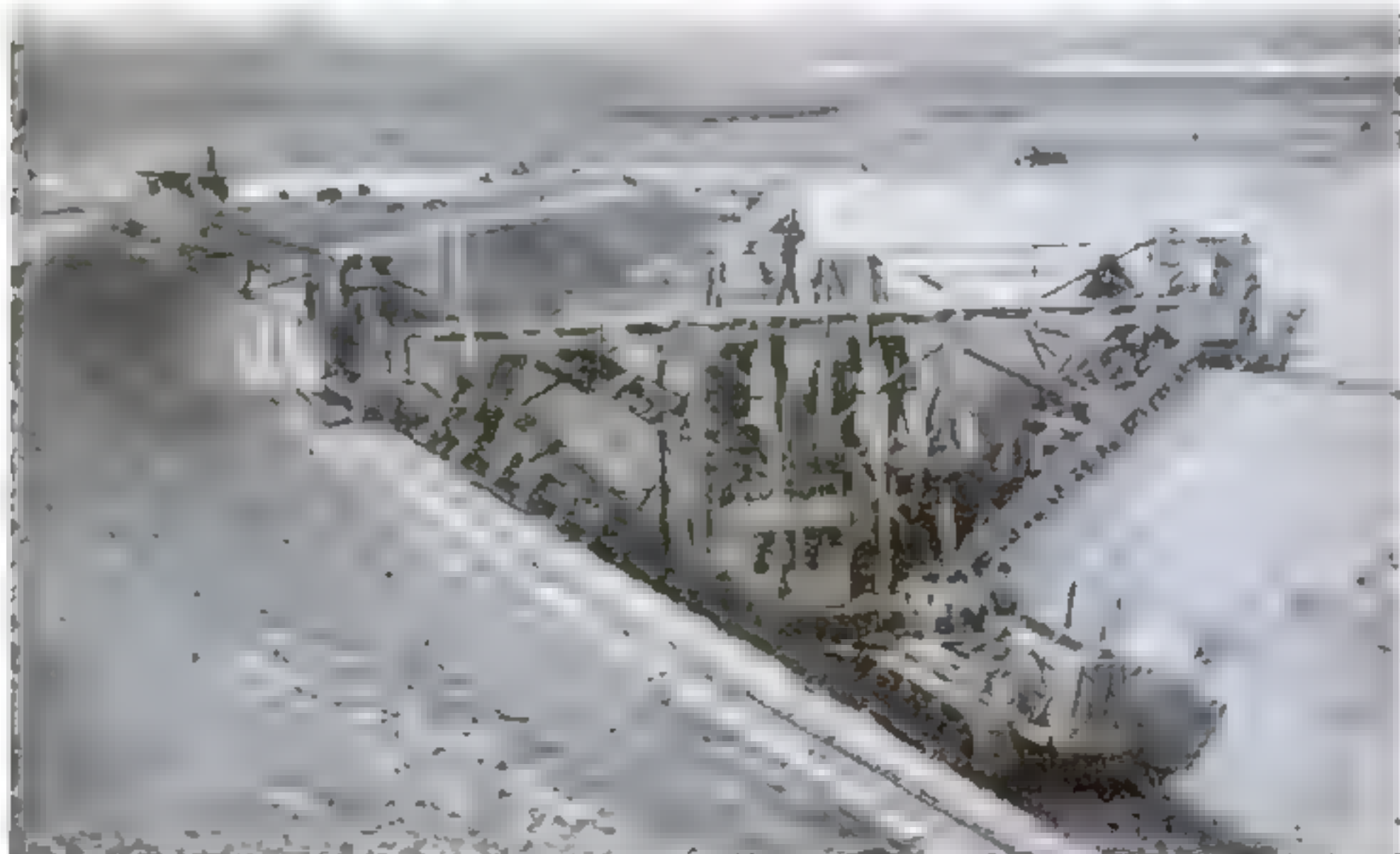
Tiny Automobile Radio Is Easily Installed

LITTLE more than a handful, a new automobile radio developed in England can be attached to the car with but a single bolt and nut. The set may be concealed, and operated by the usual flexible-cable control from the steering column, or mounted directly in a compartment on the dash. Two wave bands are covered by the tuning range of the outfit, and the change from long to short wave lengths can be made by pushing one of the knobs illustrated.

New Ditch Digger Shapes Irrigation Canals

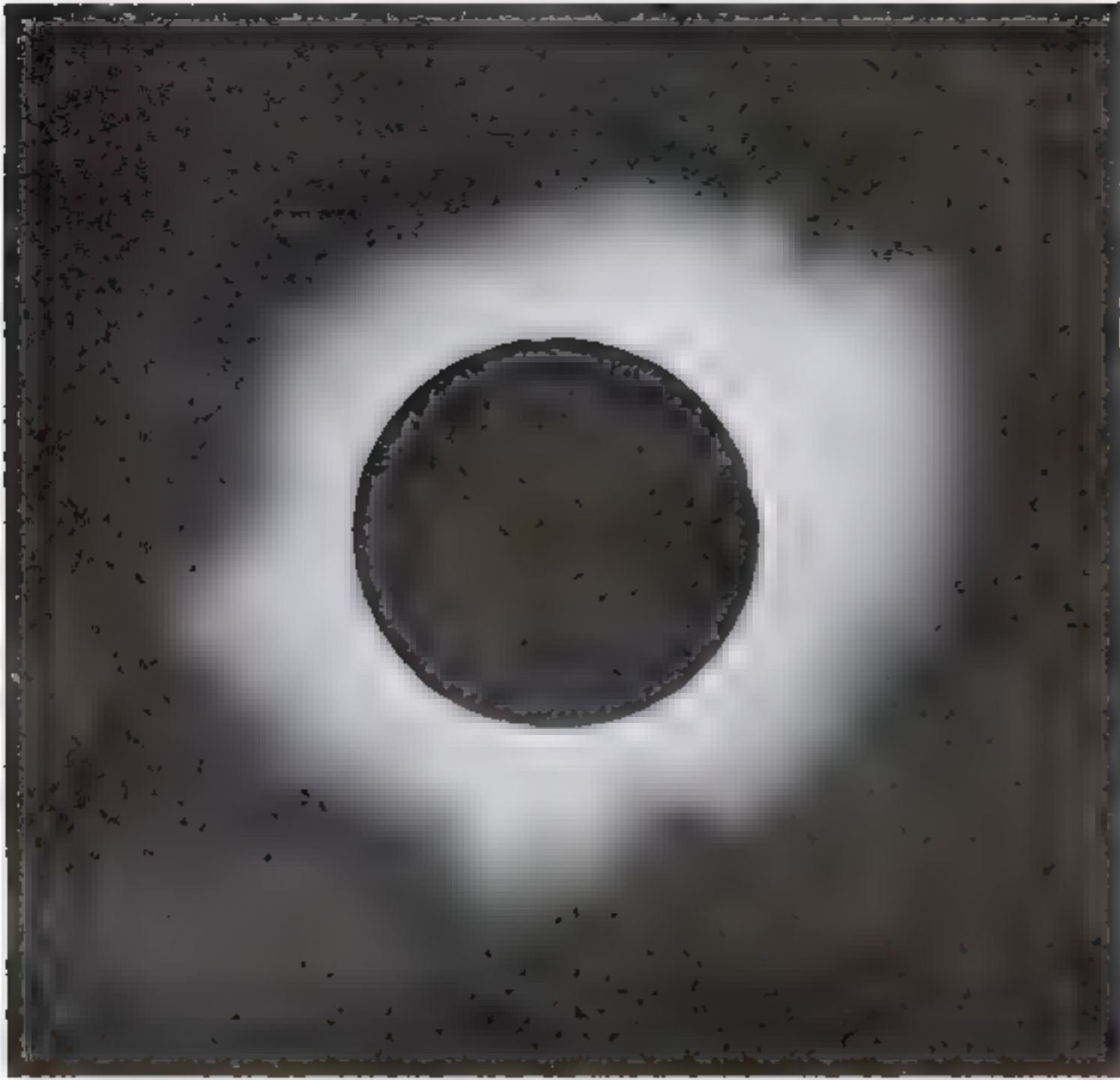
IRRIGATION work at Yakima, Wash., is aided by a huge ditch-shaping machine that finishes the sides of the canal. Steel teeth on the arms of the

digger tear away the earth, which is raised by an endless belt and deposited in a neat ridge at the side of the trench, as shown at the left, below.

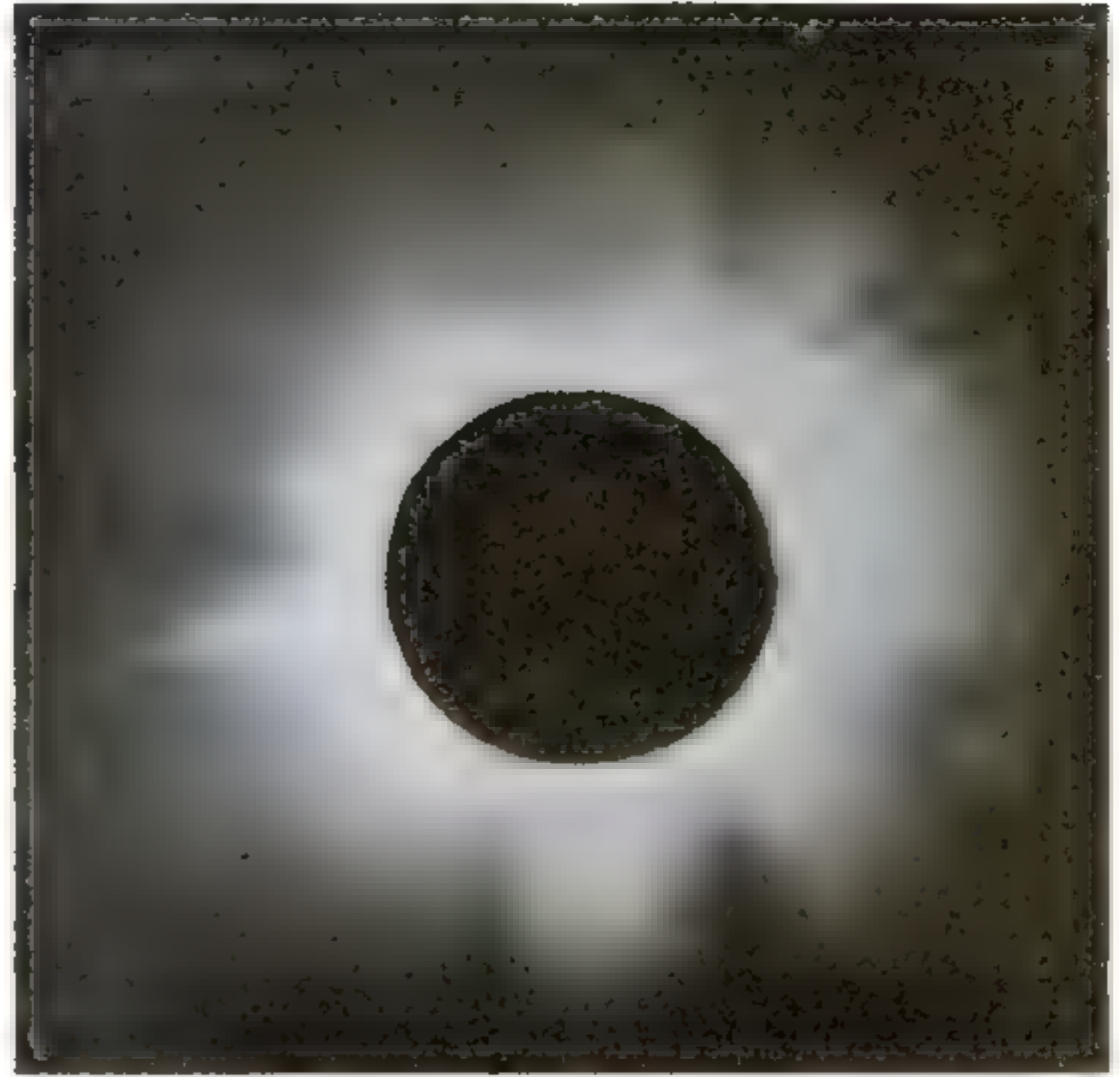


The digger at work. Teeth on the arms of the machine shape the sides of the trench neatly

Aerial Photo of Eclipse Shows Sun's True Corona



Astronomers once thought the sun's corona looked like this picture



But reflected light on aerial negatives gives this unexpected shape

UPSETTING astronomical theories, the sun's corona or glowing atmosphere is given a new shape by stratosphere photographs taken from an air-

plane over Peru during last June's eclipse. The pictures show that the brilliant coronal streamers visible from the earth during an eclipse are merely the

brightest parts of a huge globular atmosphere. Printing the aerial negatives with reflected light made the startling discovery possible.

Firemen Invent New Hose Game

STREAMS of water from fire hoses, and a ball sliding freely along an overhead wire, recently provided the implements for a novel game played by firemen at Chicago, Ill. Officially, the object of the game was to push the ball over the opponents' goal line, although to spectators it appeared as if it was primarily to drench the opponents. The players appropriately named their strenuous sport "fireball."



Hose streams drive the ball along a high overhead wire

Walking Mail Box



A race spectator using the walking mail box

WITH A POST BOX strapped to his back, as shown in the photograph, a postal employee circulated through the crowd of 200,000 at recent motor-cycle races in Germany so spectators could mail letters or post cards without leaving their seats in the grand stand.

Lost Cord Quartet Have Artificial Voices



Modern science gave voices to these men who lack vocal cords

FOUR MEN deprived of their vocal cords, but with their voices restored by an artificial larynx, formed the odd quartet, at left, as they met for a chat at St. Petersburg, Fla. The device transmits to the mouth the tone of an electrically vibrated reed, which the lips and tongue can modulate into the sounds of speech.

Periscope Aids Root Study

PERISCOPES in glass tubes forced into the ground beside plants are enabling an English research worker to study the growth of plant roots. Tiny electric lamps provide ample light for the unusual observations.

New Automobile Heater Is Mounted on Pivot

MOUNTED on a swinging bracket, a new car heater may be revolved to direct a stream of warm air just where it is wanted. A built-in auxiliary heater with an independent motor and fan defrosts the windshield.



Heated air may be directed to any part of the car



Navy Planes Fly in Perfect Formation

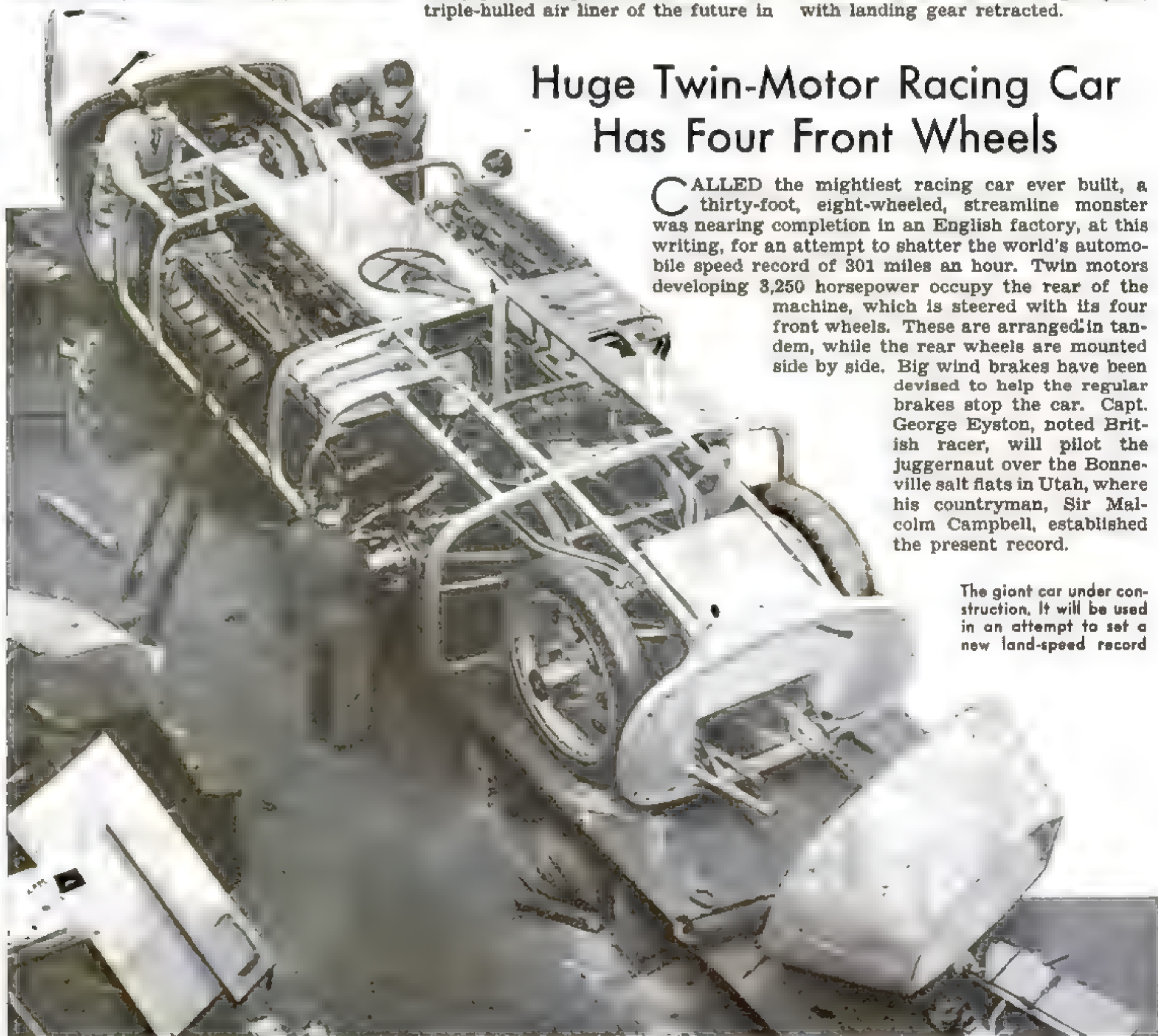
SO PERFECTLY coordinated that they seem to be flying as one, three U. S. Navy planes might be mistaken for a triple-hulled air liner of the future in

the photograph above. The pilots are giving a brilliant exhibition of close-formation maneuvers at high speed, with landing gear retracted.

Huge Twin-Motor Racing Car Has Four Front Wheels

CALLED the mightiest racing car ever built, a thirty-foot, eight-wheeled, streamline monster was nearing completion in an English factory, at this writing, for an attempt to shatter the world's automobile speed record of 301 miles an hour. Twin motors developing 3,250 horsepower occupy the rear of the machine, which is steered with its four front wheels. These are arranged in tandem, while the rear wheels are mounted side by side. Big wind brakes have been devised to help the regular brakes stop the car. Capt. George Eyston, noted British racer, will pilot the juggernaut over the Bonneville salt flats in Utah, where his countryman, Sir Malcolm Campbell, established the present record.

The giant car under construction. It will be used in an attempt to set a new land-speed record



Un-Natural History

By
GUS MAGER



THE EYES HAVE IT THIS MONTH. TAKE THE OWL, FOR INSTANCE. HE ALONE, OF ALL BIRDS, HAS HIS EYES FACING DIRECTLY FORWARD, LIKE A HUMAN'S. HOWEVER, HE CANNOT ROLL THEM IN THEIR SOCKETS—THEY ARE IMMOVABLE—FIXED!

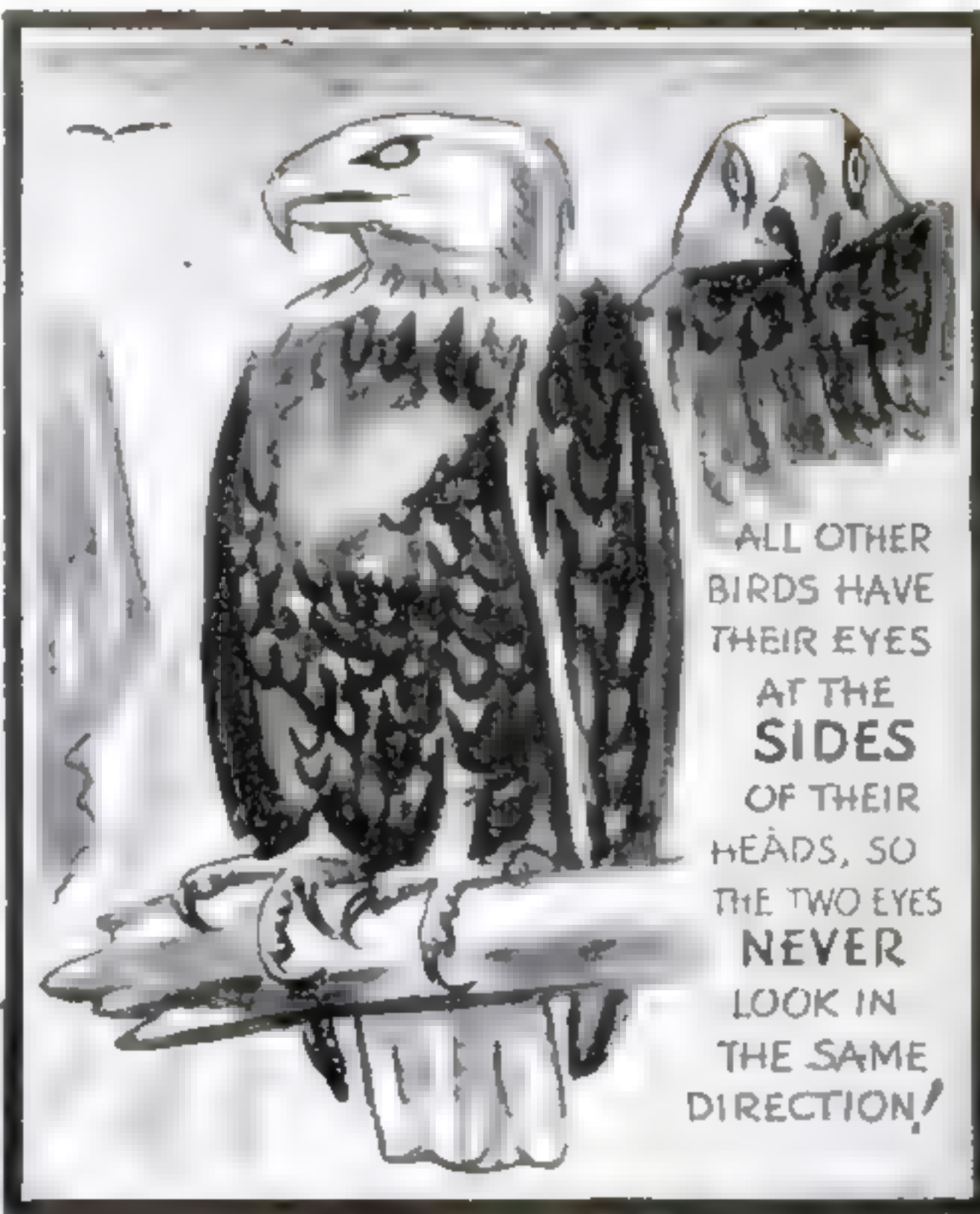
THIS YOUNG
LADY WOULD BE
BADLY HANDICAPPED
IF HER EYES WERE
IMMOVABLE LIKE
THE OWL'S...



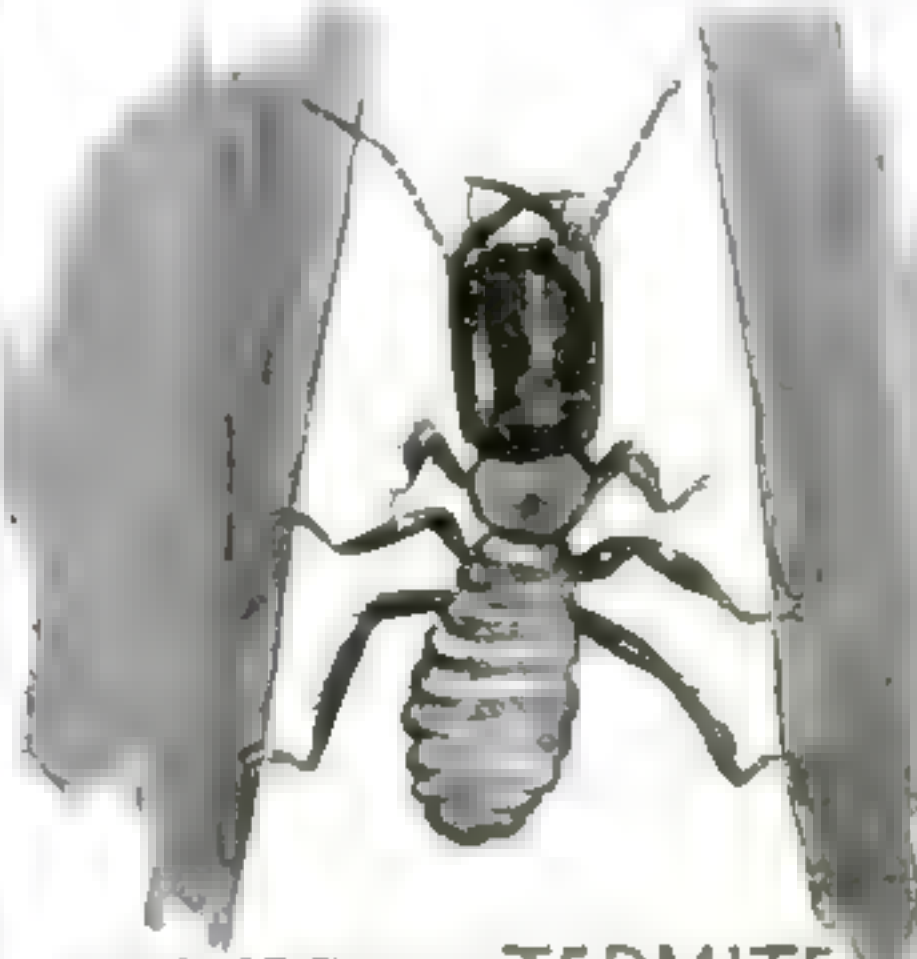
THE BIRD
MAKES UP FOR
IT BY HAVING A
REVOLVING NECK LIKE
A VENTRILOQUIST'S
DUMMY!



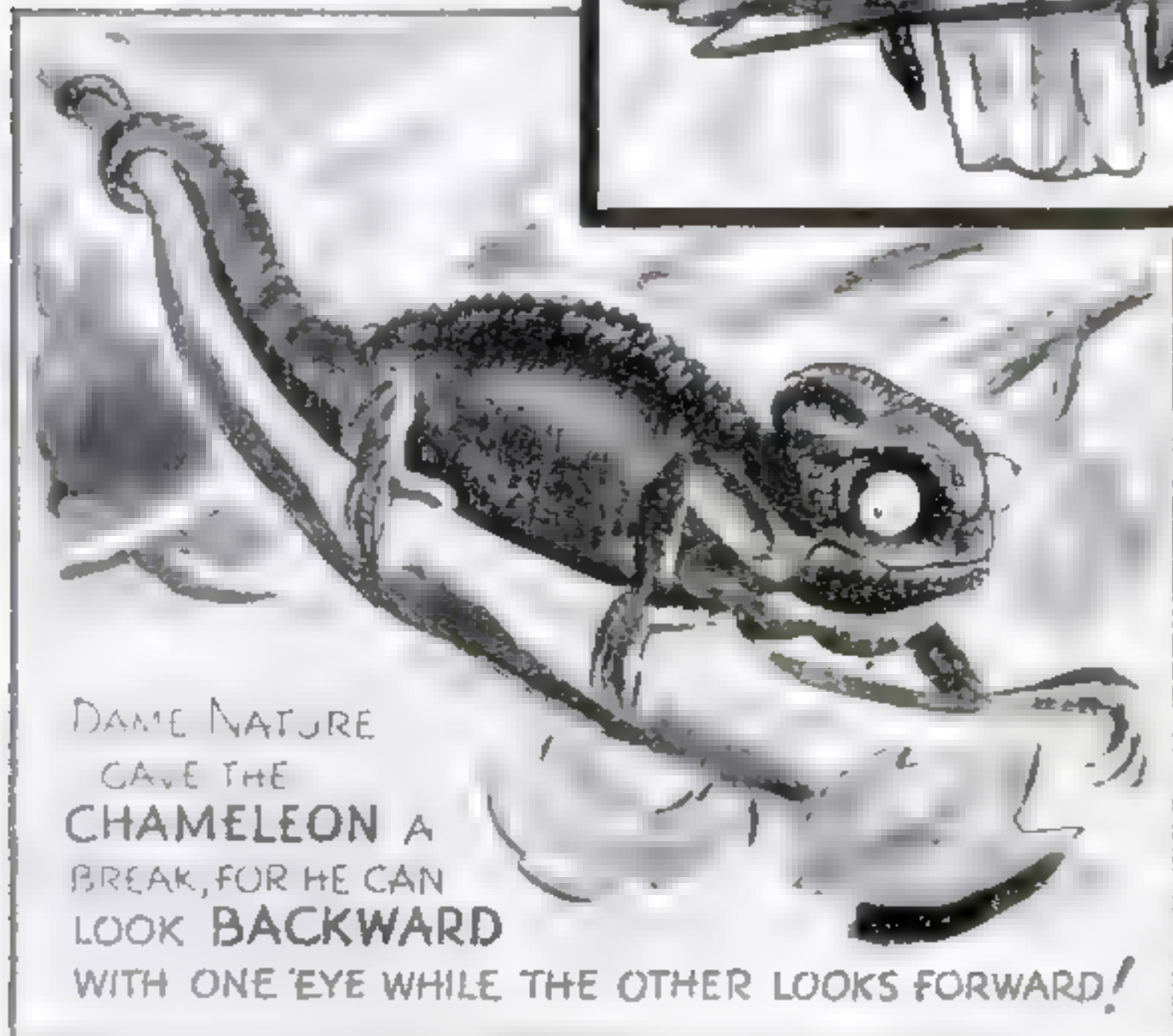
BIRDS ...
...
...
...
TRANSPARENT ...



ALL OTHER
BIRDS HAVE
THEIR EYES
AT THE
SIDES
OF THEIR
HEADS, SO
THE TWO EYES
NEVER
LOOK IN
THE SAME
DIRECTION!



SOLDIERS IN A TERMITE COLONY ARE COMPLETELY BLIND, BUT THEIR FIGHTING EQUIPMENT MAKES UP FOR THE LACK OF EYESIGHT.



DAME NATURE
GAVE THE
CHAMELEON A
BREAK, FOR HE CAN
LOOK **BACKWARD**
WITH ONE 'EYE WHILE THE OTHER LOOKS FORWARD!



"I NEVER CLOSED AN EYE, DAY OR NIGHT," SAYS THE SNAKE. OF COURSE HE DIDN'T—HIS EYES HAVE NO LIDS!



AND THE BRAVE
STARFISH
ALWAYS FACES HIS
ENEMIES, FOR HE
HAS AN EYE
AT THE END
OF EACH ARM!

Hunting Little Big Game

EXPLORING probably is the most fascinating of sports. And you can enjoy it as much as you want to—if you have a microscope. Invading new realms with your magic lenses can be just as fascinating as an expedition to the jungle or a visit to the ocean floor—and a whole lot cheaper and safer. For example, you will find the thrill of marine exploration in examining the strange creatures that inhabit the waters of stagnant puddles, garden pools, aquariums, and the like.

The microscopic animals grouped together under the general name of Protozoa provide endless entertainment for the microscopist because they are so plentiful both in form and in number. Furthermore, the Protozoa are of great importance to science because, being the simplest of living animals—consisting of but a single animated cell—they afford a means of studying fundamental life processes. For instance, a thorough study of the crawling amœba will tell the scientist much about the amœbalike cells found in the human body, and about diseases traceable to alien amœbas that get into the human system.

There are several convenient sources of protozoans. Perhaps the simplest way of collecting a supply is to go on a little expedition, equipped with a dipping tube or bottle and a jar having a screw cap, for the purpose of collecting water from stagnant ponds, lily pools, and the like. There is hardly any open body of water that does not swarm with interesting microscopic life.

The dipping tube consists merely of a straight piece of glass tubing at least a foot long. If the ends of the tube have sharp edges, heat the glass in a gas or

alcohol flame until the edges have become rounded. To use the tube, hold one end shut with your finger and plunge the other end into the water to the required depth. Then raise your finger for a moment to permit the trapped air to escape. The water will rise in the tube to its normal level. Replace your finger, and you can lift the tubeful of water and empty it into your collection jar. In such collecting, try to get a considerable quantity of solid material from the pond bottom. The slimy layer that usually covers the bottom is rich in living creatures.

A dipping bottle is a small glass bottle or vial fastened to the end of a stick so that it looks like a glass-headed croquet mallet. It is used like a dipper to scoop material from the bottom of streams or ponds.

When you have returned to your microscope desk, transfer, with a dipping tube or medicine dropper, a drop or two of the pond water to a clean microscope slide. Get some of the solid material, too. Lay a clean cover glass over the drops, and you are ready for the trek into unknown country. As for magnifications, fifty or 100 diameters is sufficient for general searching, because this gives a less restricted field and better illumination, to say nothing of the clearer definition in many microscopes. After you have located an interesting specimen, and perhaps persuaded it to remain still by one of the methods described below, you can switch to higher powers for closer study.

A hay infusion, made by putting dried grass into a jar half full of water and letting it stand, will provide many interesting specimens



To slow up the movements of tiny animals, you can snare them with cotton, or put them to sleep with an anesthetic, as shown below



HUNTING PROTOZOANS

Living creatures are easily captured in stagnant ponds or lily pools with the simple dipping bottle pictured here. It is made by fastening a small vial to the end of a stick by means of rubber bands, as illustrated above, and is used like a dipper to scoop up samples from promising locations

Because of the great many different protozoans it is impossible to describe all of them here. However an attempt will be made to mention, at least, some of the more common and important varieties.

Biologists have divided the Protozoa into three groups, the amœboid protozoans or Sarcodina, the flagellate protozoans or Mastigophora, and the ciliate protozoans or Infusoria.

The first group gets its name from the amœba, simplest of one-celled animals. These creatures have one outstanding characteristic: they move about by extending the protoplasm that makes up the cell until it forms tem-

with Your MICROSCOPE

By
MORTON C.
WALLING

In a drop of water,
you will find crea-
tures as strange as
those of any jungle



Vorticella campanula anchored to a fixed object by its springlike stem. At the right is a group of protozoans, with stream-line Euglenas in greatest numbers

porary feet, pseudopodia. The amoeba literally flows into its foot, as you will discover by watching one with your microscope. *Amoeba proteus* is the best-known member of the group. It is essentially a naked single cell, looking not unlike a drop of jelly that contains several solid particles.

When first placed on a slide, the amoeba usually gathers itself into a globular drop, but after a time you will see a branch grow out from the drop and perhaps another and another.

These are the temporary feet. With them, the amoeba moves about, engulfing bits of food. The processes that go on inside an amoeba are rather complicated and can best be studied with the aid of a good textbook that describes them in detail.

Other members of the amoeba's family may take any of a variety of appearances. Some of them secrete a substance that hardens into a protective covering. Others gather together tiny grains of sand and cement them into

a hollow shell. You will be astonished by the skill displayed by these simple creatures, for the grains look as if they had been fitted together by a master mason, and the shape is as uniform and exact as if an architect or engineer had supervised the work. Typical of these sand-grain masons is *Diffugia urceolata*. It builds an ingenious sand shell shaped like an old-fashioned balloon. The inside compartment of the shell is slightly larger than that (Continued on page 143)

Some Things You Should Know About Microscope Lenses

THE term "compound microscope" is used to distinguish a certain type of multilens magnifying instrument from simple microscopes such as Sherlock Holmes's reading glass. A compound microscope consists essentially of a tube having at its lower end an objective lens or system of lenses and at its upper end an eyepiece or ocular system.

The objective acts like a tiny, short focus simple lens—it may even be such a lens—and magnifies the object on the slide, forming an image near the upper end of the tube. The eyepiece, acting like another simple lens, is focused on the image formed by the objective and magnifies it still further.

Magnification of a microscope is commonly changed in one of three ways—by using a higher or lower-powered objective, by using an eyepiece of different magnifying power, or by increasing or decreasing the tube length.

In selecting a microscope, magni-

fication should be a secondary consideration. Magnification alone is worthless; the lenses must give good resolution as well. In other words, the details of the magnified image must be clear. A cheap instrument may produce a magnification of 500 diameters, as the manufacturer claims, but the image will be so blurred because of poor resolution that nothing whatever is gained by the magnification.

Resolution depends primarily upon the materials and workmanship that go into the lenses. The use of high-grade optical glass, plus careful grinding to eliminate as many of the inherent lens faults as possible, is necessary. Such things cost money, which accounts for much of the seemingly high price of a good microscope.

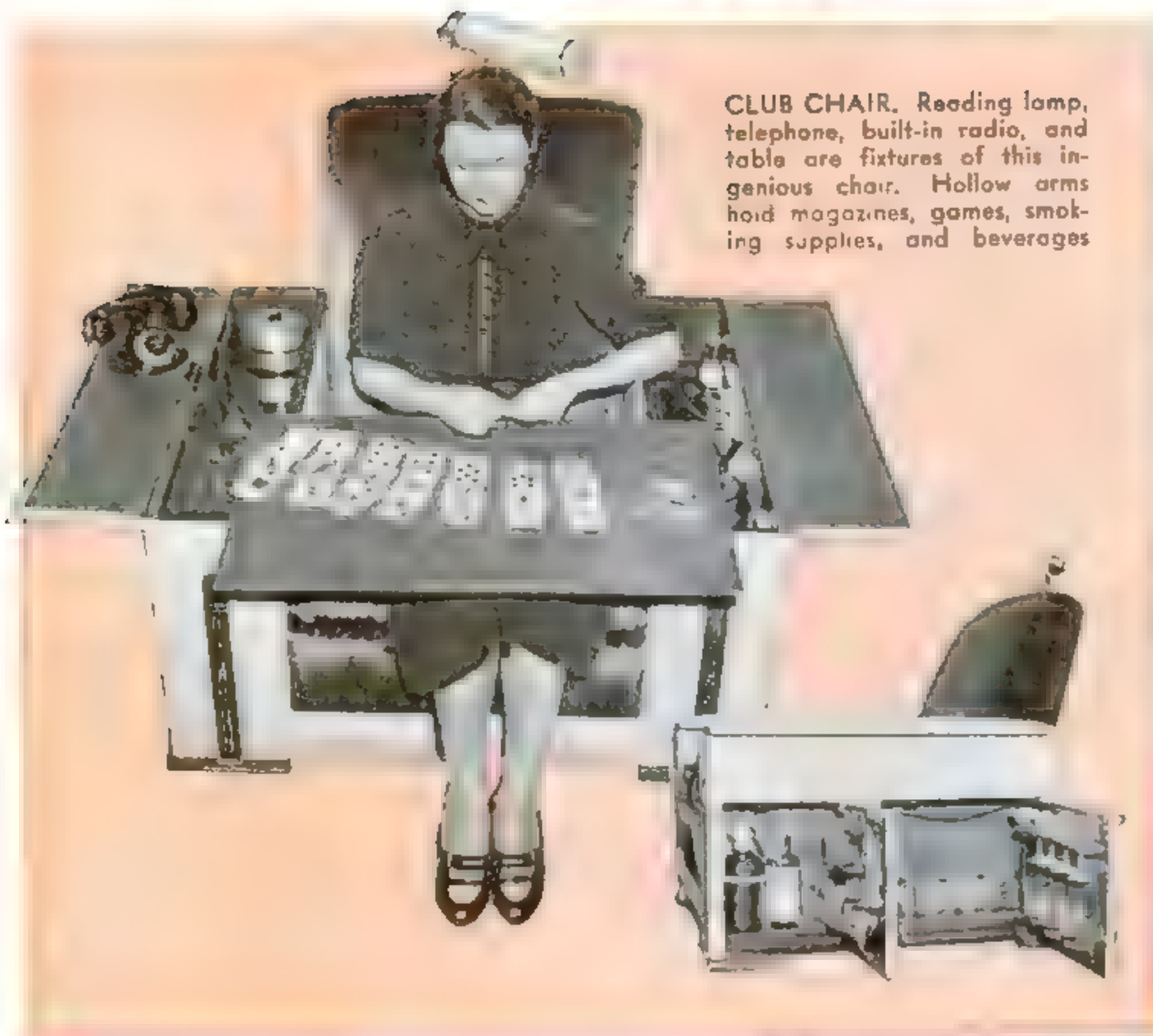
Microscope lenses may or may not be marked to indicate their power and other characteristics. Present-day practice is to mark "professional-type" objectives to indicate their focal

length, magnifying power, aperture, and sometimes the degree of color correction. Usually of greatest interest to the average amateur is the power, generally stamped in some such way as "10 X," meaning that the lens has a linear magnification of ten. Amateur microscopes seldom are marked for objective power.

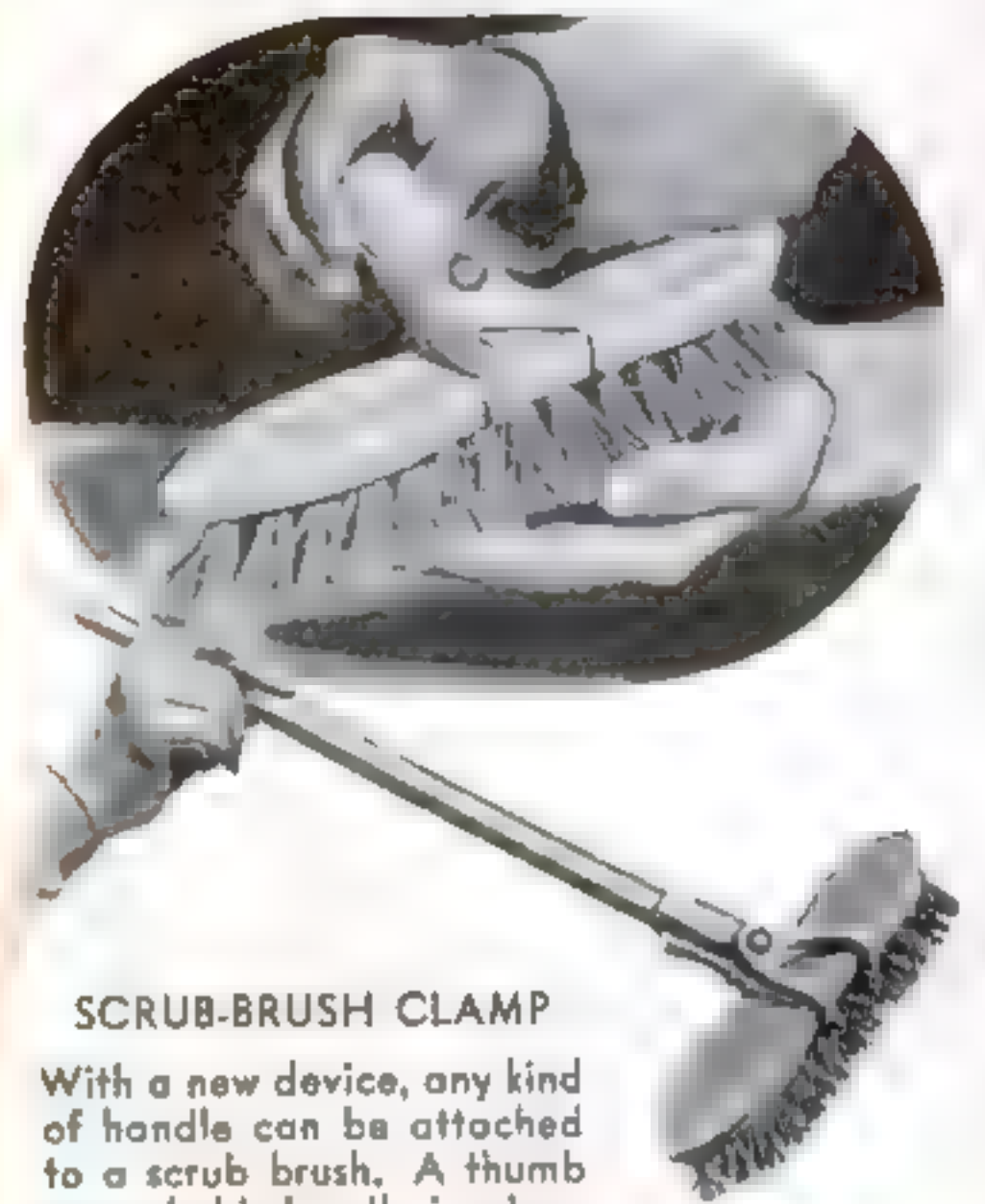
Eyepieces, when marked, bear some such figure as 5 or 10, or maybe 5 X or 10 X, indicating the number of times they magnify the image formed by the objective. Special eyepieces, such as those intended for use with objectives highly corrected for color, bear further markings. Again, many amateur microscopes bear no markings on the oculars.

Total magnification of a compound microscope is determined accurately enough for all practical purposes by reading the scale on the draw tube, when one is provided, or by multiplying the magnification of the objective by that of the eyepiece.

HANDY AIDS



CLUB CHAIR. Reading lamp, telephone, built-in radio, and table are fixtures of this ingenious chair. Hollow arms hold magazines, games, smoking supplies, and beverages



SCRUB-BRUSH CLAMP

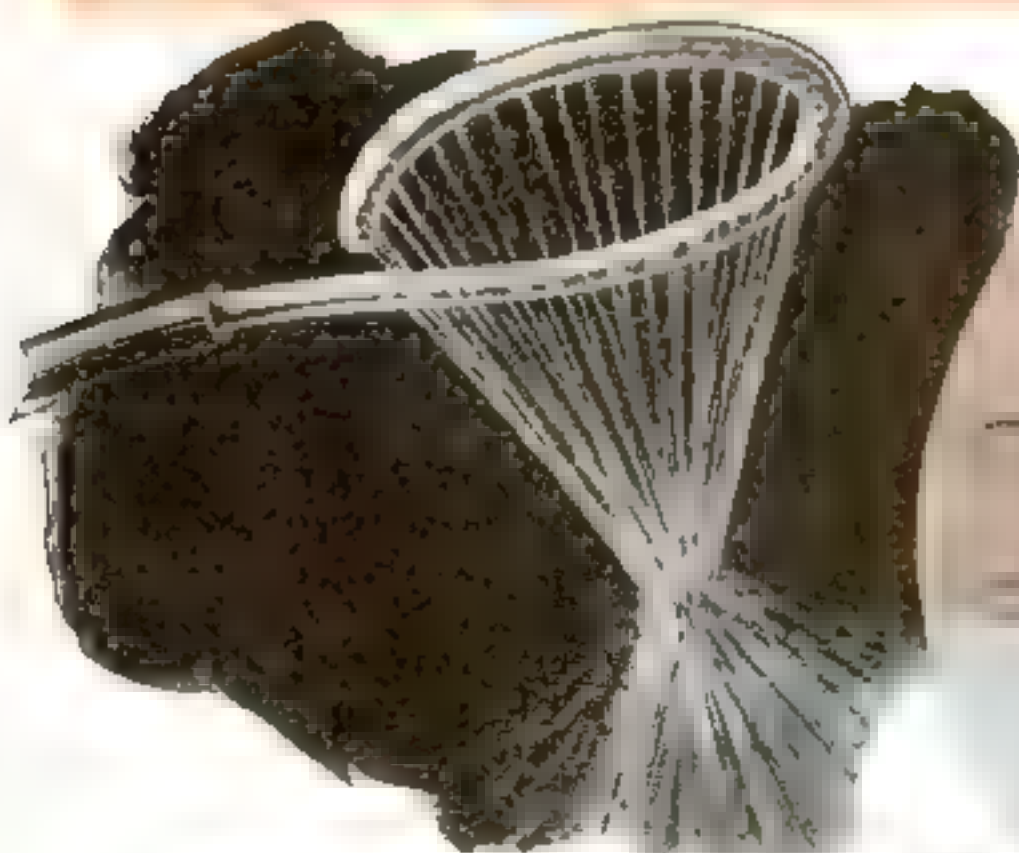
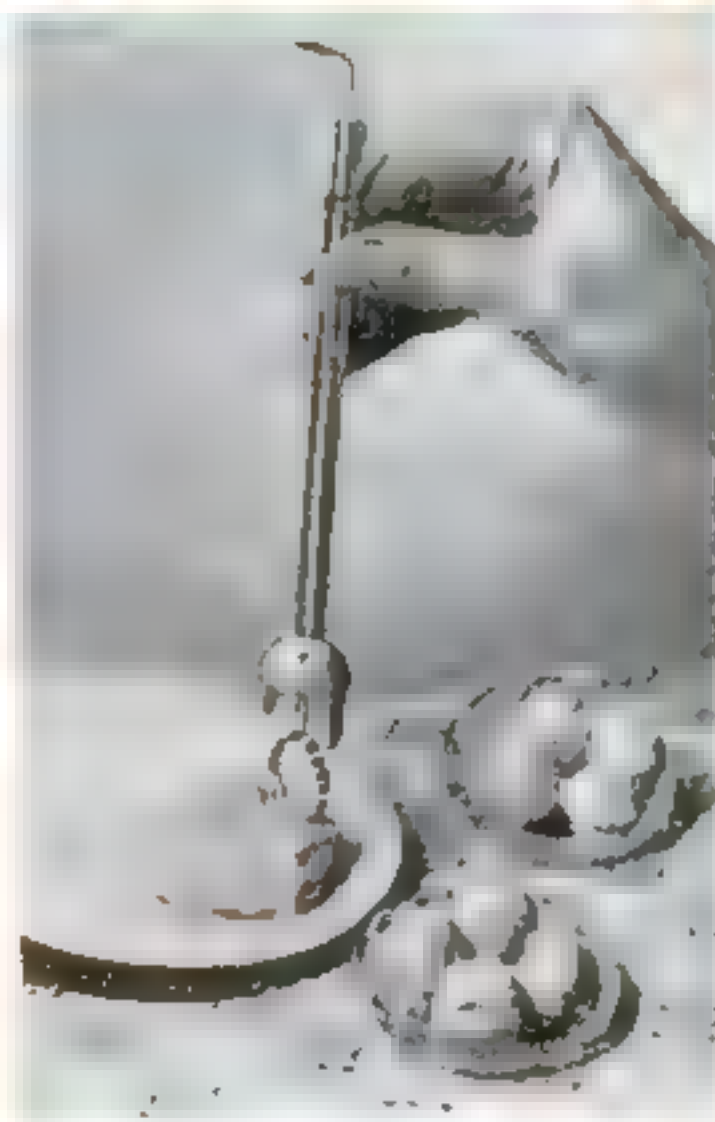
With a new device, any kind of handle can be attached to a scrub brush. A thumb screw holds handle in place

BUTTER SHAPER. Butter, cream cheese, and other soft foods can be shaped into balls with the rotating loop of the new kitchen accessory shown at the right



CLEANS KNIVES

The knife sharpener at the left also has a cleaning feature built into its handle. The blade is inserted under a hinged section and rubbed back and forth against special surfaces that remove tarnish and stains from the steel

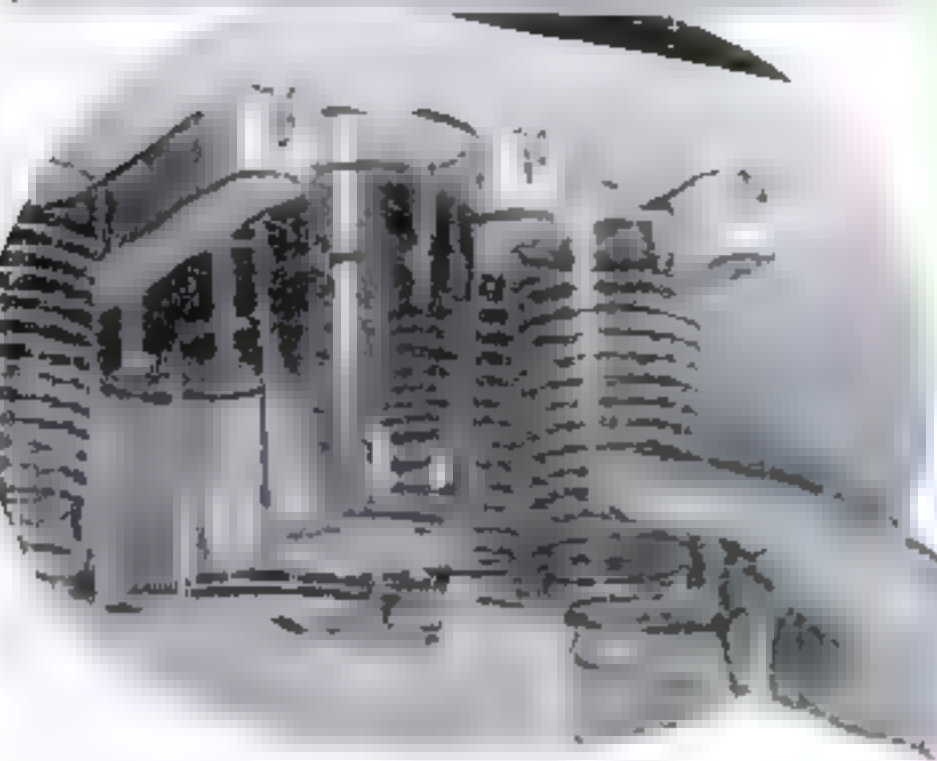
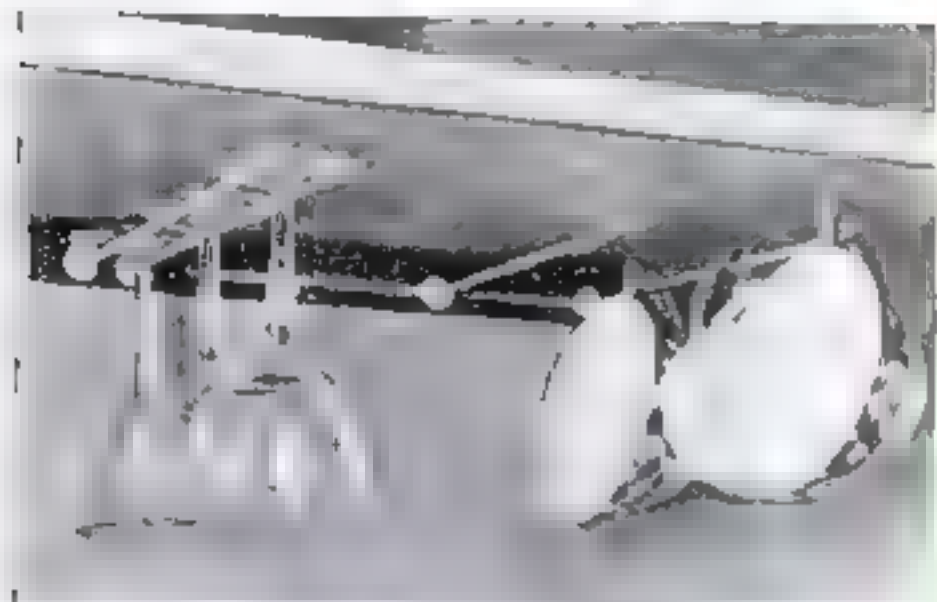


WHIRLPOOL SHOWER. Focusing jets of water into a miniature whirlpool, a new shower attachment for tub use rinses soap lather off the body or out of the hair in a jiffy without splashing



ADJUSTABLE CUPBOARD SHELVES. Mounted on a vertical rod inside a built-in cupboard, shelves of a new type can be adjusted to any desired height. The shelves are removable circular trays that rest on revolving brackets

FOR THE HOUSEHOLD



CUPS AND GLASSES are stored compactly in cupboards equipped with new-type fittings. Horizontal rods support cups and stemware, while tumblers are held by rubber cushions



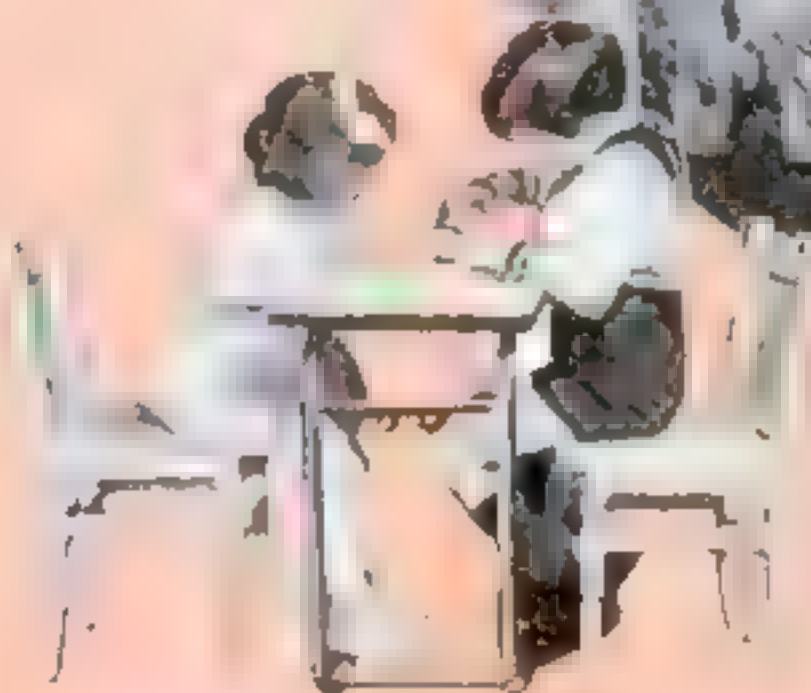
SALTCELLAR. When the two small wheels in the cap of this novel saltcellar are turned with the finger, any lumps are broken up so that the user may spread the salt evenly over the food



NOVEMBER, 1937

HANDY TABLE

Designed for use in bed or with a comfortable chair, this table has a C-shaped frame of tubular steel. The height is adjustable, and the mahogany top can be tilted at an angle



The unusual construction of the table allows plenty of leg room and makes it convenient for children



BROOM HOLDER

A rubber cup that slips on the end of a mop or broom handle has a hole for hanging on a nail or hook in the closet. This keeps the business end off the floor, where it would pick up dust or possibly be damaged

WASTEBASKET RECEPTACLE

Hooked over the rim of an ordinary wastebasket, a glass receptacle provides a handy place to put fruit peels, tobacco ashes, cigar and cigarette butts, and similar things. It has a hinged cover



COMBINED CRIB AND PLAY PEN

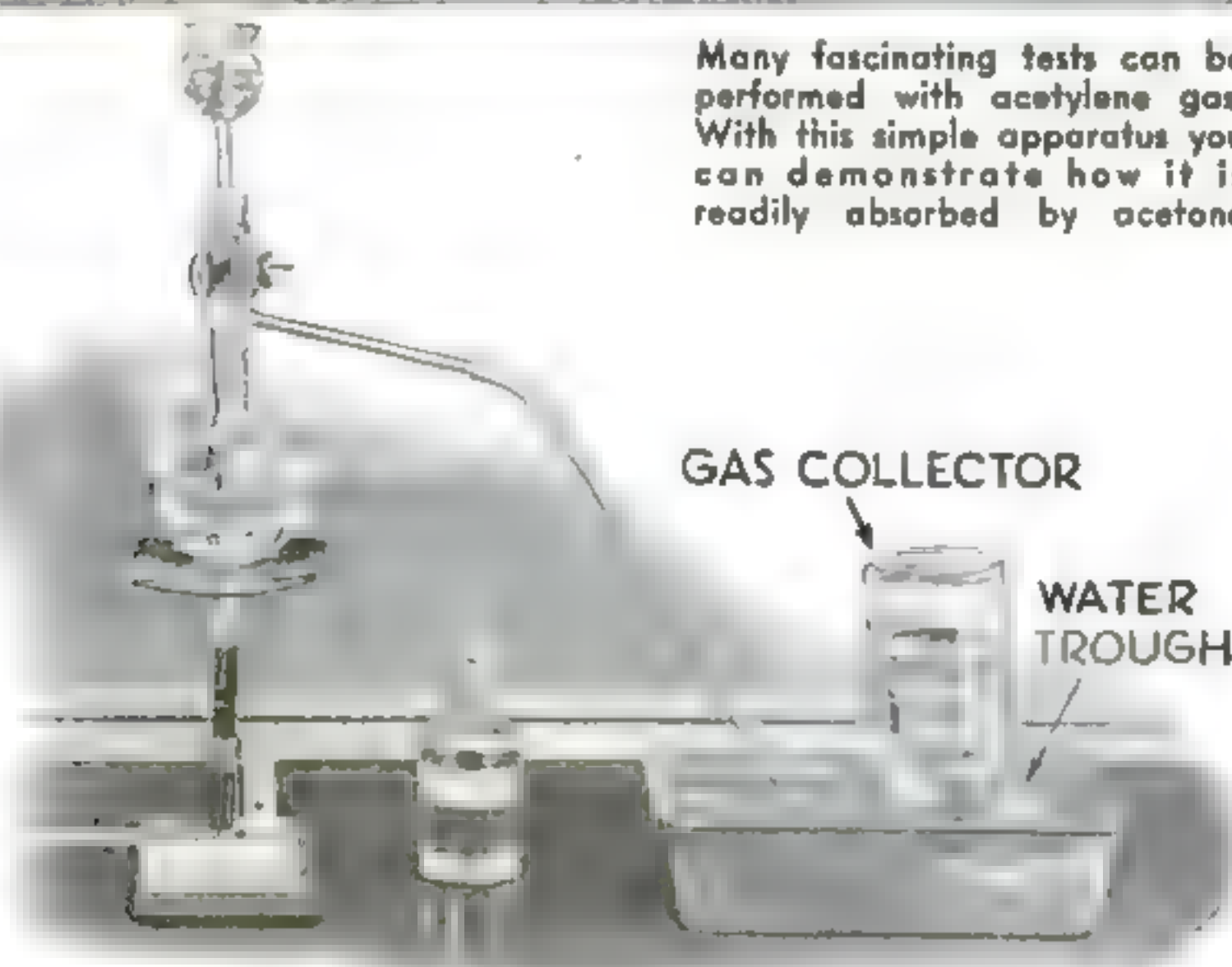
A play pen by day, the versatile piece of nursery furniture illustrated above can be readily converted into a crib. The mattress frame is supported by the crossbars



BASKET COOKER. Macaroni, spaghetti, potatoes, and many other foods are easily prepared in this special utensil. The perforated inner pan keeps food from sticking and makes thorough draining a simple matter. The lid fits either the inset or the outer pan, which can be used alone



Many fascinating tests can be performed with acetylene gas. With this simple apparatus you can demonstrate how it is readily absorbed by acetone



Heating alcohol and sulphuric acid together produces ethylene gas, which can be collected easily in inverted, water-filled bottles



Tiny explosions and spectacular light flashes result from the reaction of chlorine gas with acetylene in the experiment above

Fun with

Hydrocarbons Are a Subject for Many Spectacular Experiments in the Amateur's Chemical Laboratory

By **RAYMOND B. WAILES**

WOULD you like to get gas from coal without heating the coal? To make an inflammable gas that will dissolve in certain liquids as easily as sugar does in coffee? To produce a gas that burns with a flame you can hardly perceive? Or to create fiery bubbles of gas, jumping about like grasshoppers, from simple everyday chemicals? These are some of the curious and interesting experiments with hydrocarbon gases that any amateur chemist can easily perform.

Hydrocarbon gases are compounds of carbon and hydrogen. A large proportion of all natural gases, including methane, ethane, propane, and butane, belong to this group. Manufactured illuminating gas—both coal gas and water gas—contains hydrocarbon gases, together with non-hydrocarbons such as hydrogen, carbon monoxide, carbon dioxide, and nitrogen.

Everyone knows that heating coal in a closed chamber or retort produces inflammable coal gas. Less familiar is the fact that coal slowly gives off hydrocarbon gases even without being heated. Miners know this, for they often hear the gas escaping with a hissing noise from fissures in underground seams of coal. They call it fire damp and must guard against it, for it forms a dangerously explosive mixture with air. Chemically speaking, fire damp is largely methane.

You can easily collect the same gas from ordinary house-furnace coal. A few days before you want to observe the result, pound up several large double handfuls of hard or soft coal into fragments the size of peas, or finer, and place the pulverized coal in a deep bowl of water. Connect the stem of a glass funnel to the glass part of a medicine dropper with a four-inch length of rubber tubing, and place the funnel, mouth down, over the coal. Suck the water up until it fills the funnel, and close the rubber tubing with a pinch clamp or a spring-type clothespin. Then let the set-up stand. From day to day, you will observe bubbles of gas rising from the coal, particularly when you tap the bowl, and they will be trapped under the glass bell of the funnel. In several days you should have a cupful of methane gas. Then, if the water level outside the funnel is higher than within, the gas will escape from the tip of the medicine dropper when you open the pinch clamp. You can light it, and it will burn with a pale blue flame.

Gas that bubbles up through the water of marshes also is methane. You can collect it by stirring up the muddy bottom of a lily pool, or the ooze at the bottom of a marsh, and trapping the ascending bubbles under an inverted funnel. The marsh gas, too, will burn.

Methane can be manufactured in your home laboratory from sodium acetate. Place an ounce or two of the crystals on the lid of a tin can, or in a porcelain evaporating dish, and heat the material slowly. Soon it will become liquid. Continue heating for at least ten minutes more, to dehydrate or dry the sodium acetate. When it cools, if the heating has been sufficient, it will no longer be crystalline but will resemble powdery snow.

To the dehydrated sodium acetate, add about one tenth of its volume of sodium hydroxide (ordinary household lye will do) and an equal amount of unslaked lime (calcium oxide). Mix the ingredients thoroughly. Now place the mixture in a test tube, or an ignition tube closed at one end. Stopper the tube with a one-hole cork

Explosive Gases

FOR HOME
CHEMISTS

in which you have fitted the glass portion of a medicine dropper.

Heat the tube slowly, and wave the burner flame along its entire length every ten seconds or so. This will keep its whole surface at a high temperature and prevents water vapor from condensing, running back, and cracking the hot glass. Soon the chemical mixture will melt and methane gas will be given off at the end of the miniature retort system. Light it with a match, and it will burn for five minutes or more. Sodium compounds from the chemicals in the tube, borne along as a spray by the gas, tinge the flame yellow.

Methane gas does not react readily with most other chemicals. In contrast, showy experiments can be performed with acetylene, another hydrocarbon gas. This is the gas that produces the fierce oxyacetylene flame used for cutting metals, when it is burned with oxygen in a special torch. Acetylene has also found service in rural-home lighting and in bicycle and miners' lamps.

To generate acetylene and study its properties, obtain a can of calcium carbide, commonly sold simply as "carbide." A bicycle shop or a sporting-goods store is your most likely source of supply. Several lumps of the chemical placed in a large jar or can of water will liberate a copious quantity of acetylene. A bottleful of the gas may then be collected for experiment by guiding the stream of bubbles through a funnel into the submerged mouth of an inverted bottle filled with water, the rising gas displacing the water. Before you lift out the bottle of acetylene, cover the mouth with a sheet of glass or close it with a cork, to retain the gas until you are ready to use it.

Hold a match to the mouth of a bottle filled with acetylene. The gas will burn with a brilliant yellow flame, depositing a large amount of soot or carbon. If you let air mix with the acetylene and then apply a match, the gas mixture will explode with a plop. The explosion is harmless, provided you take care to use a bottle with a wide mouth.

WHEN acetylene burns, it turns into carbon dioxide and water. These are the oxides of carbon and hydrogen, of which two atoms apiece make up the acetylene molecule. After you have burned a bottleful of acetylene gas, place several drops of clear limewater in the bottle and shake the liquid about. A white precipitate of calcium carbonate will turn the limewater milky, showing the presence of carbon dioxide, for which this is a test. The black flakes of soot in the bottle will not interfere. They float, due to the fact that they do not become wet with the liquid.

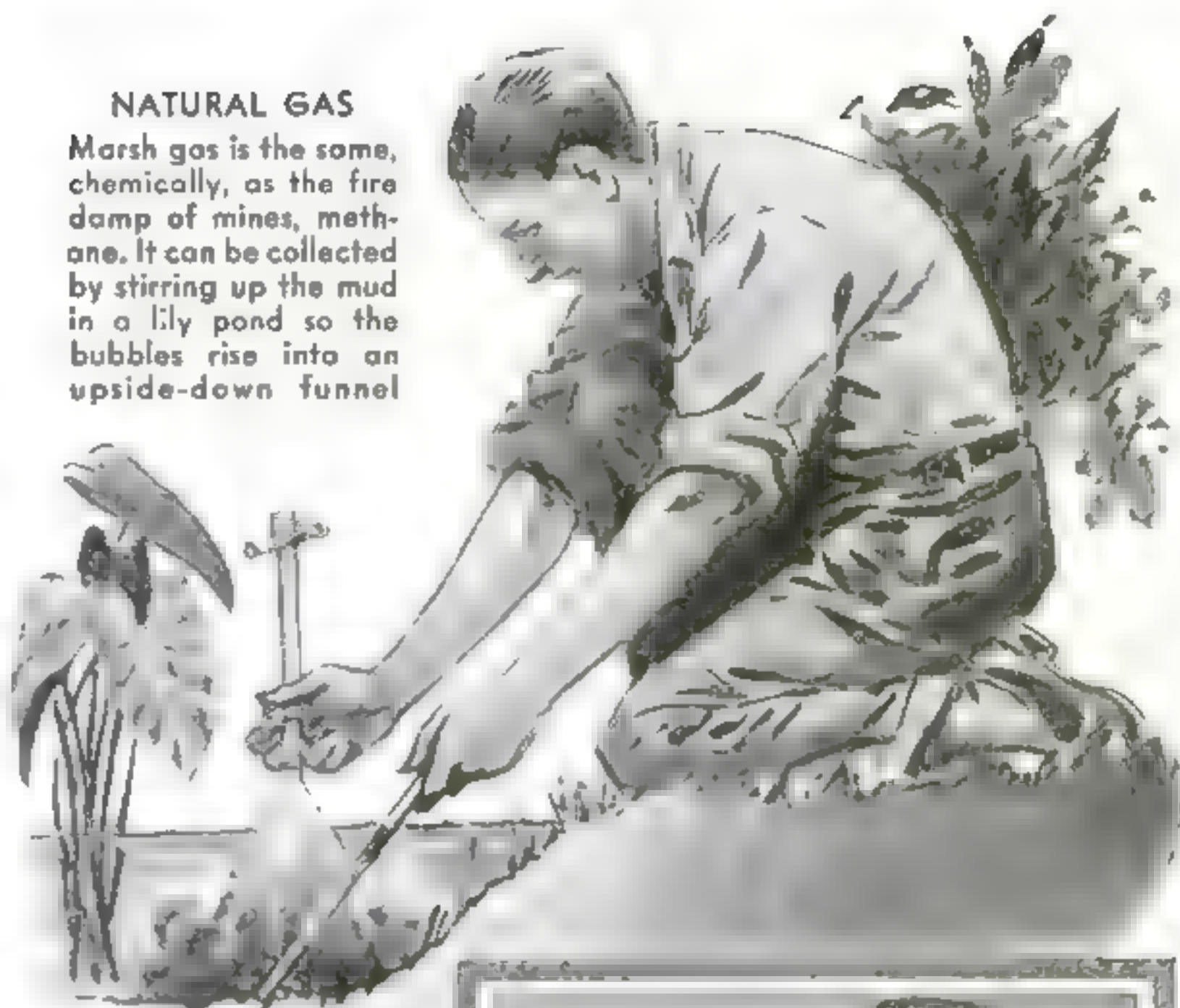
Acetylene will combine with a number of gases, and its reaction with chlorine is a spectacular one. To demonstrate this, place about a teaspoonful of ordinary bleaching powder (calcium hypochlorite) and about a fluid ounce (one eighth of an ordinary drinking glass) of water in a wide-mouthed bottle. Then add ten or twenty cubic centimeters (half a fluid ounce, more or less) of muriatic, or hydrochloric, acid. Chlorine gas is produced, and may be recognized by its yellowish color.

When the bottle has become filled with the gas, toss in a few lumps of calcium carbide. Falling into the water in the bottle, the carbide immediately gives off acetylene gas. As each bubble of acetylene bobs to the surface of the liquid, it comes in contact with the overlying chlorine gas, and the two gases react vigorously with each other. Each contact produces a flash of light, a tiny explosion, and a little cloud of soot. With the bombardment proceeding at the rate of several explosions a second, the bottle resembles a miniature battlefield.

Just as a lighted wax taper or a jet of burning hydrogen will continue to burn when it is lowered into a vessel filled with chlorine, so this (Continued on page 146)

NATURAL GAS

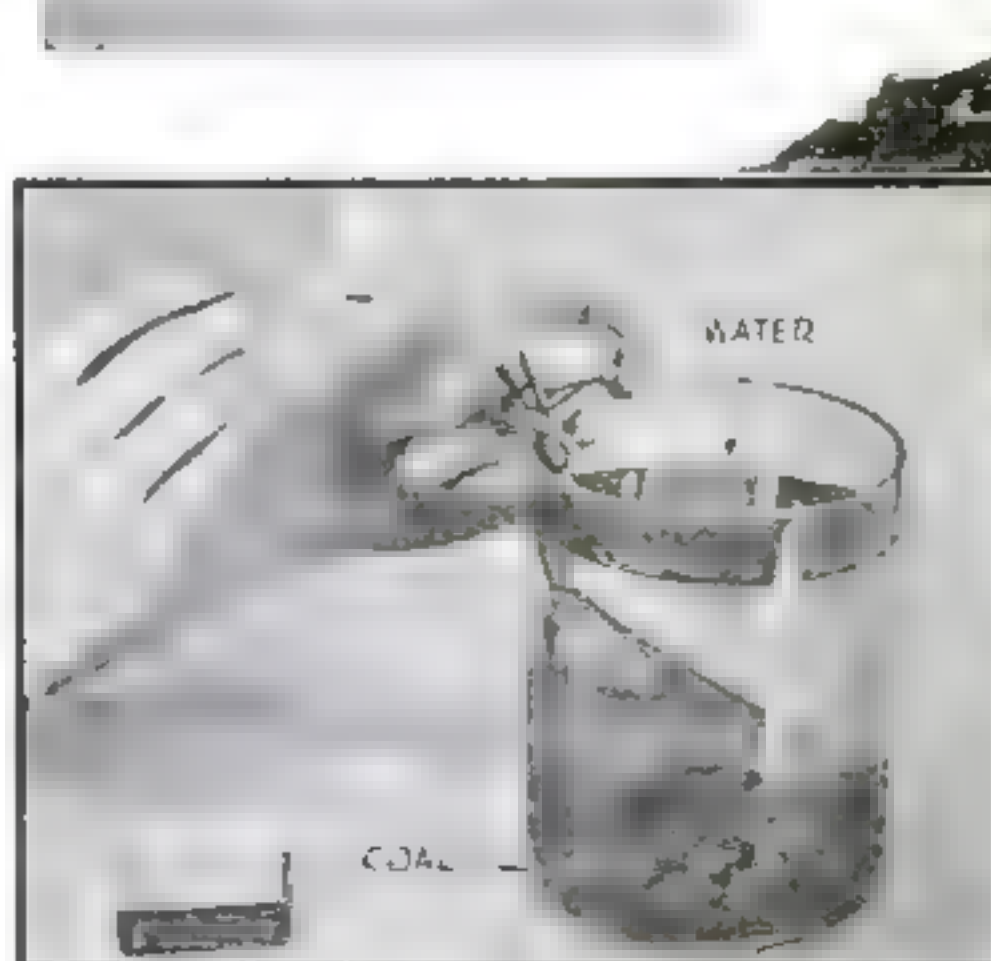
Marsh gas is the same, chemically, as the fire damp of mines, methane. It can be collected by stirring up the mud in a lily pond so the bubbles rise into an upside-down funnel



In the experiment below, acid dripping into the flask absorbs the ethylene gas it contains. A vacuum is formed, sucking water from the tube

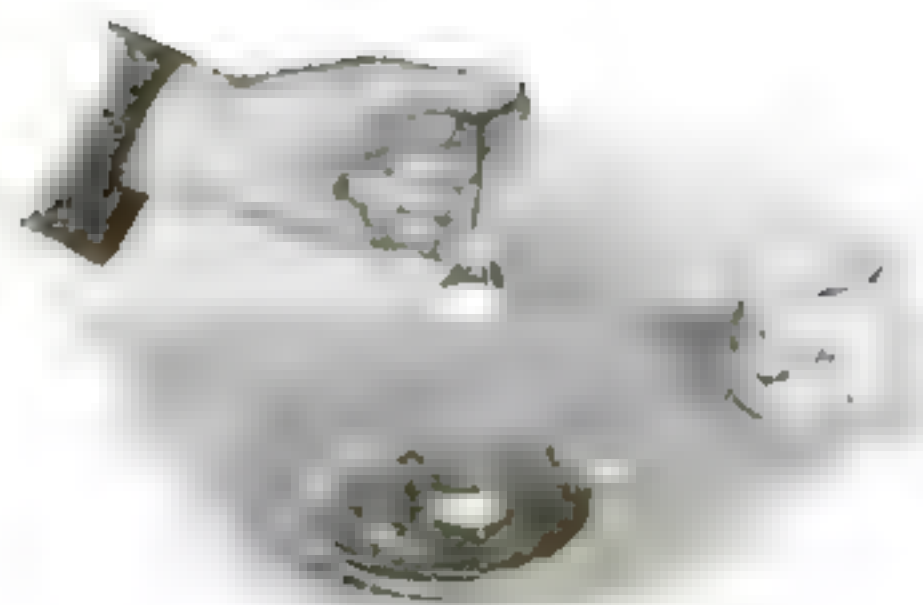


METHANE GAS is easily prepared by heating a mixture of sodium acetate, lye, and quicklime in a test tube as shown above. The gas flowing from the outlet burns readily



FIRE DAMP, the cause of many mine explosions, issues from all coal. A quantity can be collected in an inverted funnel as shown in the illustration at the left

HOME TESTS OF Scientific Facts

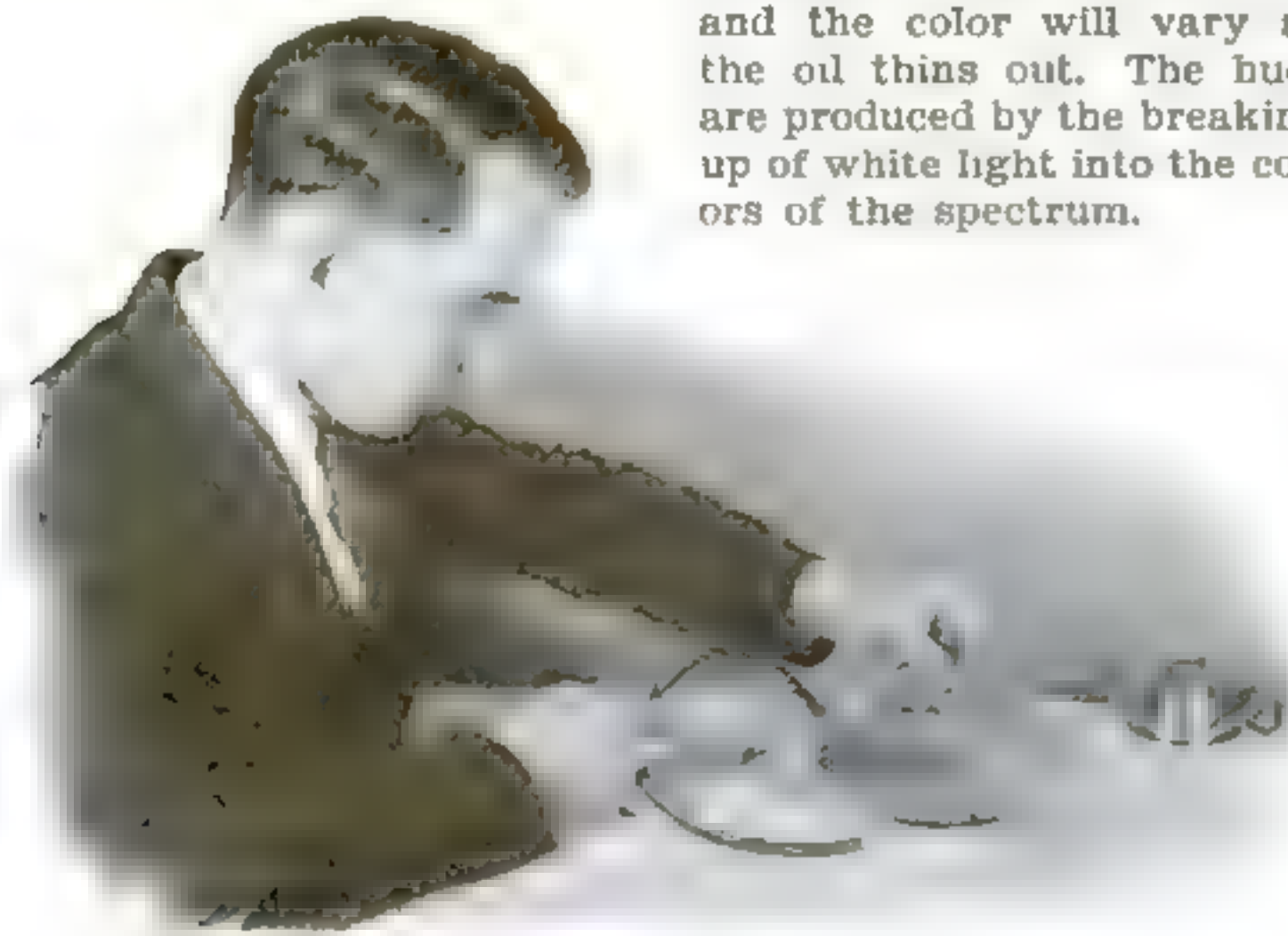


Easy Experiment Shows How Plants Get Water

THE manner in which plants absorb water through apparently solid membrane walls is easy to demonstrate with a piece of transparent cellulose wrapping material, a saucerful of water, and a little sugar. Place the cellulose over the saucer so its center touches the liquid. No water will come through. Now sprinkle on a little sugar, and the water will diffuse through by a process called osmosis and dissolve the sugar. Water will always travel from the weaker solution in the saucer to the stronger solution above the membrane.

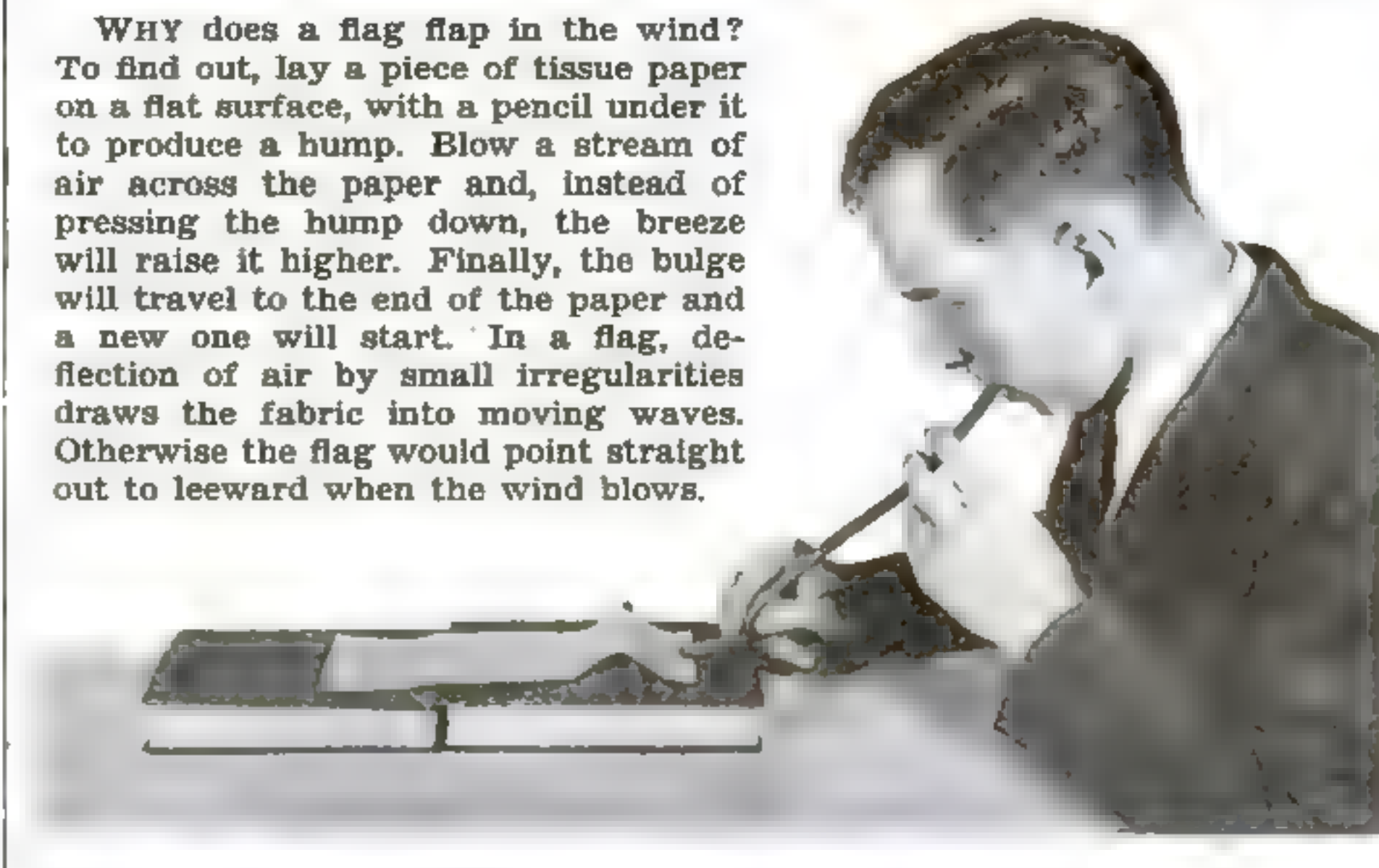
Why Oil on Water Appears Colored

BEAUTIFUL color effects produced by oil on water are caused by the reflection of light of different wave lengths by the upper and lower surfaces of the oil film. Changes in the thickness of the film produce variations in the colors. You can show this by putting a tiny drop of oil on a saucerful of water. As the oil spreads, it takes on different hues. Add oil, and the color changes as the film becomes thicker. Blow air from a hose on the oil, and the color will vary as the oil thins out. The hues are produced by the breaking up of white light into the colors of the spectrum.



Deflected Air Makes Flags Flap in Wind

WHY does a flag flap in the wind? To find out, lay a piece of tissue paper on a flat surface, with a pencil under it to produce a hump. Blow a stream of air across the paper and, instead of pressing the hump down, the breeze will raise it higher. Finally, the bulge will travel to the end of the paper and a new one will start. In a flag, deflection of air by small irregularities draws the fabric into moving waves. Otherwise the flag would point straight out to leeward when the wind blows.



Shape of Slope Affects Speed of Descent



MAKE three different slopes of cardboard as shown at the left—one a straight incline, another the arc of a circle, and the third curved sharply at the upper end. Roll marbles down them and you will find that, while all descend the same distance and therefore have the same speed at the bottom, some reach it sooner than others. The straight incline is slowest and the sharp curve, called an arc of a cycloid, is the fastest of the three.

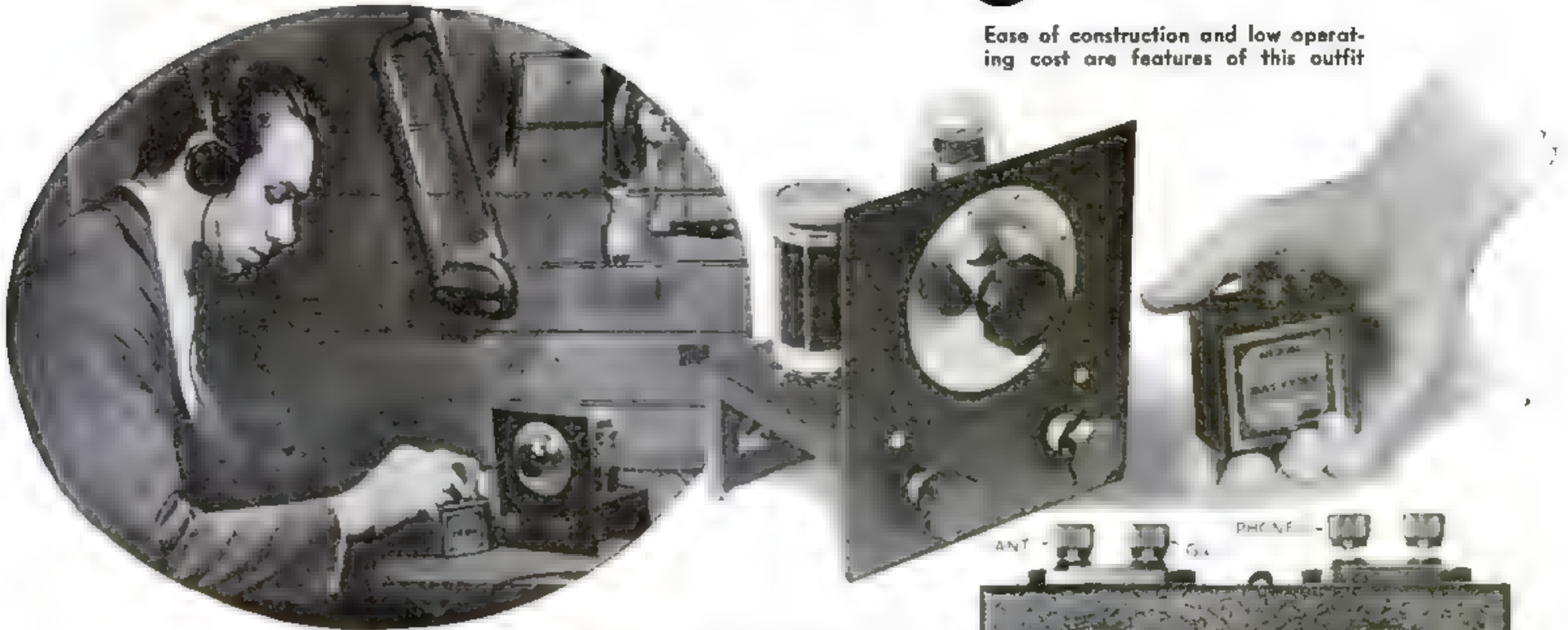


Short Tube Speeds Flow of Water

WATER flows faster from a tank through a short tube than through a plain hole of the same diameter. Take two similar cans, and punch a neat, round hole near the bottom of one. In the other can, insert a short piece of tubing whose bore is the same diameter as the first hole. Cover the openings with your fingers, fill the cans with water, and remove both fingers at once. In a given time, more water will pour from the can that has the tube, than from the other. The shape of the outlet causes the difference.

ONE TINY BATTERY OPERATES THIS Homemade Midget Radio

Ease of construction and low operating cost are features of this outfit



By Arthur Miller

ONE tiny battery, the size of a package of cigarettes, supplies all the power needed for this novel, homemade receiver. It makes an ideal portable outfit for campers and hikers, and for use in isolated sections where electric power is not available. All parts are standard and readily obtained, while the single, three-volt, "A" battery is inexpensive and provides excellent service.

Good earphone volume with the limited power supply is made possible by a special circuit designed by the writer and described in a previous issue (P.S.M., July '36 p. 52). As shown in the wiring diagram, the grid connections to the dual-grid, '49 tube are the opposite of those employed in the ordinary circuit. The usual method employs the grid nearest the filament as the control grid, but with the low plate voltage, available from this small battery, no regeneration would result. Therefore, the grid next to the filament is given a positive voltage, which attracts the electrons to the plate, giving the same result as a higher "B"-battery voltage.



When wiring the circuit, make sure that the grids of the tube are reversed, as indicated

LIST OF PARTS

- C₁.—Variable condenser, antenna trimmer, .0005 mfd.
- C₂ and C₃.—Variable condensers, .00014 mfd.
- C₄.—Fixed grid condenser, .00015 mfd.
- R₁.—Resistor, grid, 3 megohm.
- L₁, L₂, and L₃.—Plug-in coils, six-prong, broadcast band.
- L₄.—Shielded radio-frequency choke, 10 mh.
- Miscellaneous.—Chassis, panel, sockets, tube, dial, knobs, earphones, battery, wire, nuts, screws, solder, lugs, etc.

Care must be taken in selecting the various parts needed for the set. Because of the small power supply, it is important to avoid losses, and this applies particularly to the variable condensers and the coils. Note also that a shielded radio-frequency choke having an inductance of ten milhenries is specified. This part, too, is important, for if the plate choke is of inferior quality, or is not shielded, it may be difficult to get the set to oscillate.

Regeneration is obtained by means of the variable condenser, C₂. If, when the set is completed, no regeneration can be obtained, try reversing the connections to the tickler coil, L₂. If this fails, unscrew the antenna-coupling condenser, C₁. If both of these expedients fail, the trouble is probably caused by the use of an outside aerial that is too long. Disconnect the antenna from the set entirely, and substitute a ten to twenty-foot length of insulated wire, running it along the floor of the

How the parts are placed and wired. The upper photograph shows the coil, tube, and condenser

room, or concealing it around the top of the baseboard. Tune the set slowly, operating the regeneration control and tuning dial simultaneously to obtain the best quality and volume.

New Ideas for Radio Fans

High-Fidelity Speaker Comes in Kit Form

HIGH-FIDELITY reproduction of voice and music is obtained by special loudspeaker cabinets now available to amateurs, either in knock-down form, or as assembled units. To obtain good tone and quality on low notes without objectionable resonance, the speaker is built into a rigid frame so designed that the sound waves radiating from the back of the speaker are allowed to escape only through apertures of special acoustical design, while sound-absorbing material eliminates vibration and unpleasant booming.

Duo-Purpose Wave Trap Kills Interference

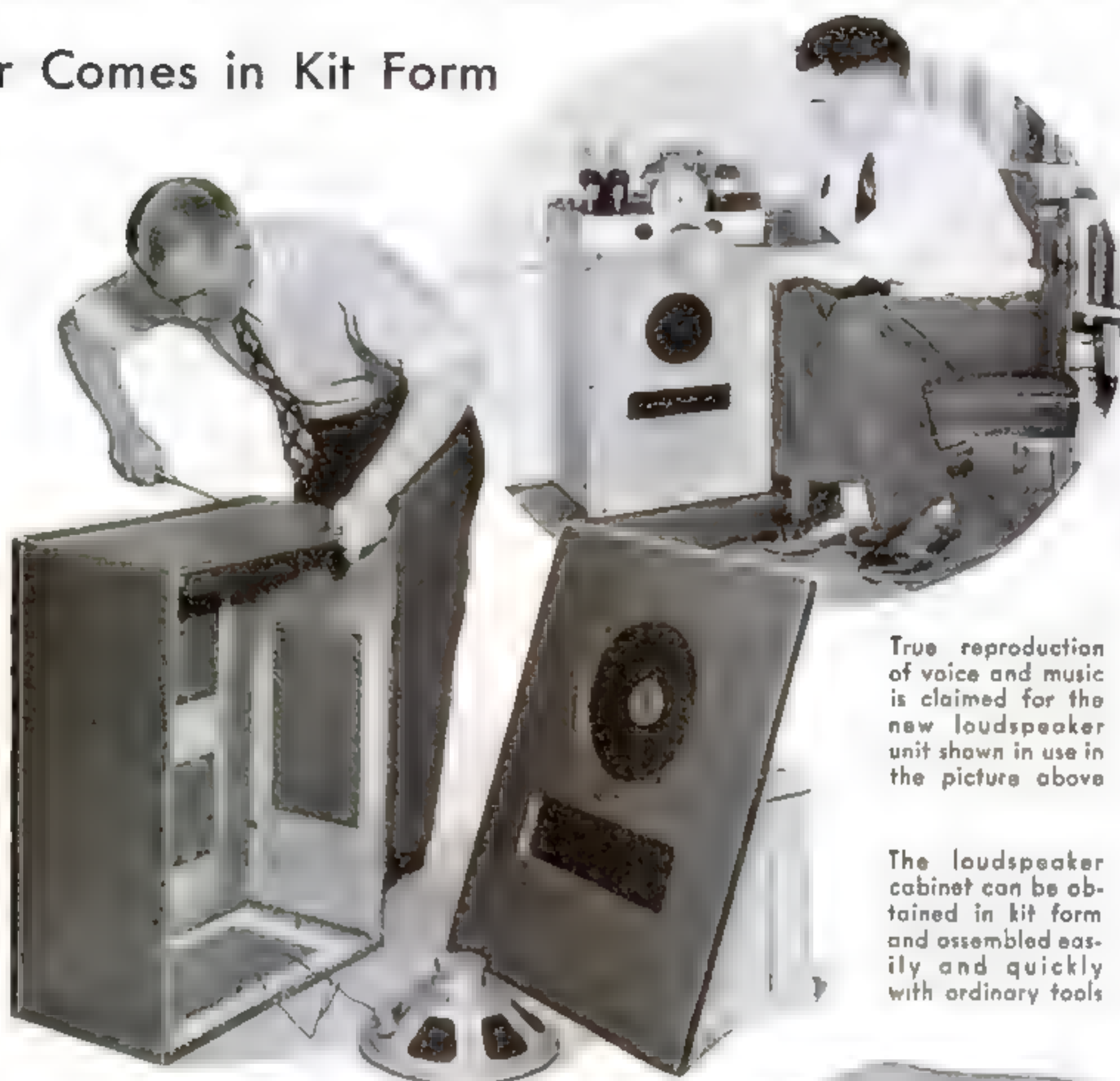
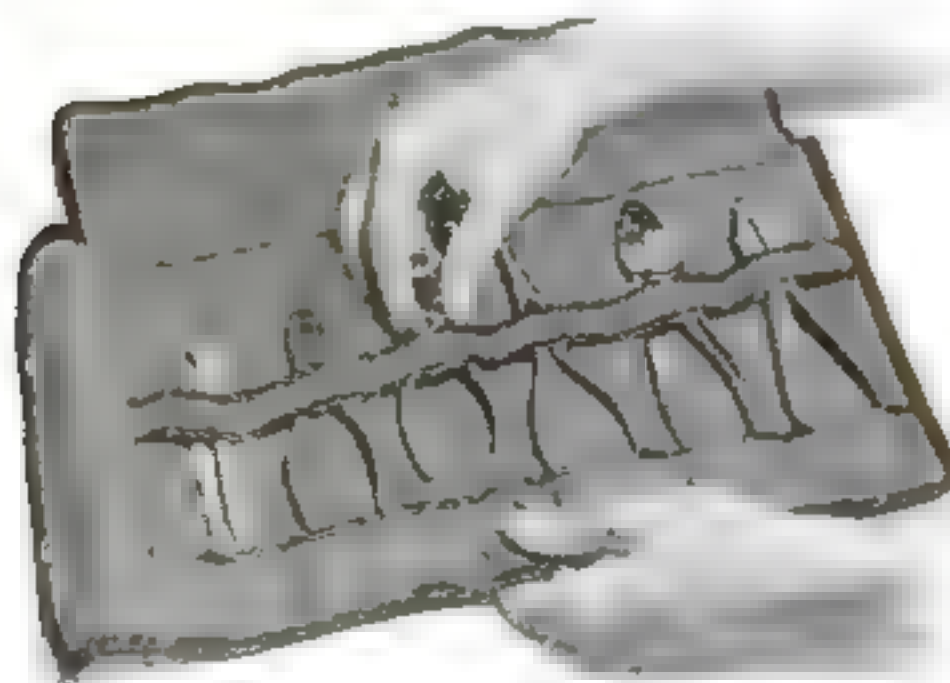
WITH a new wave trap now on the market, the radio fan can provide himself with radio reception free from interference from code transmitters and near-by broadcasting stations. Two adjustments are provided—one blocks out interfering code stations; and the other makes it possible to eliminate strong broadcast stations.



Adjusting the trap to eliminate interference. It is mounted inside the receiver cabinet.

Plier Outfit Contains Six Handy Radio Tools

SIX tools for the radio amateur are supplied in a convenient leather case that takes up little room. Flat and round-nose pliers of various types, along with wire cutters, are included in the set. Among the tools is a handy wrench-type plier that is especially useful for tightening the thin knurled nuts used in mounting potentiometers and other parts to a receiver panel.



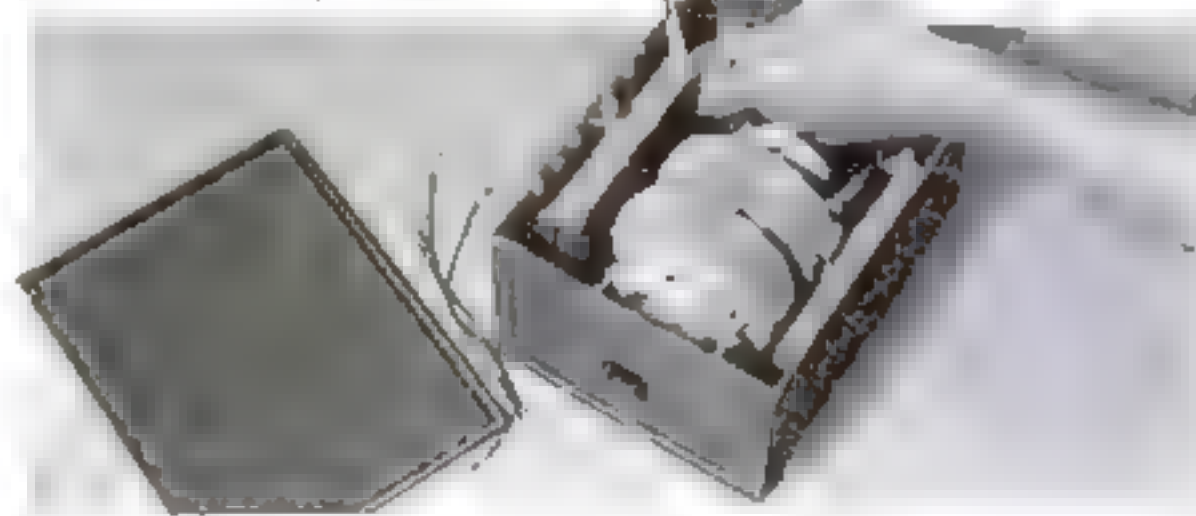
True reproduction of voice and music is claimed for the new loudspeaker unit shown in use in the picture above.

The loudspeaker cabinet can be obtained in kit form and assembled easily and quickly with ordinary tools.

Static Filter Is Adjustable

MAN-MADE static caused by sparking electric motors and switches can be eliminated at the source with an adjustable filter recently developed. Usable under a wide variety of conditions, the unit has a series of condensers so that the right value can be selected. In use, the filter is connected between the offending appliance and the power line.

Changing the connections gives a choice of filter capacities.

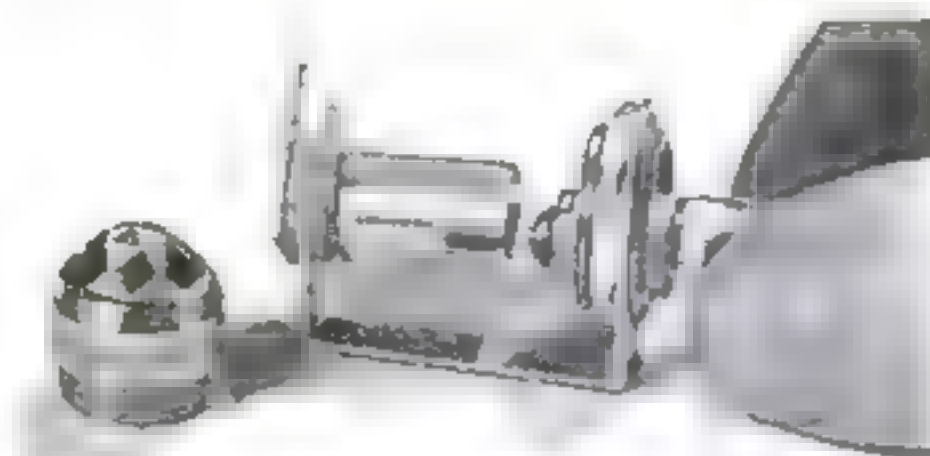


Compact Pilot Light Has Removable Lens

LITTLE space is taken up by a new pilot light for receivers and other radio equipment. The jeweled lens, available in different colors, can be removed from the front, making it easy to replace the lamp, which fits in a bayonet-type socket.

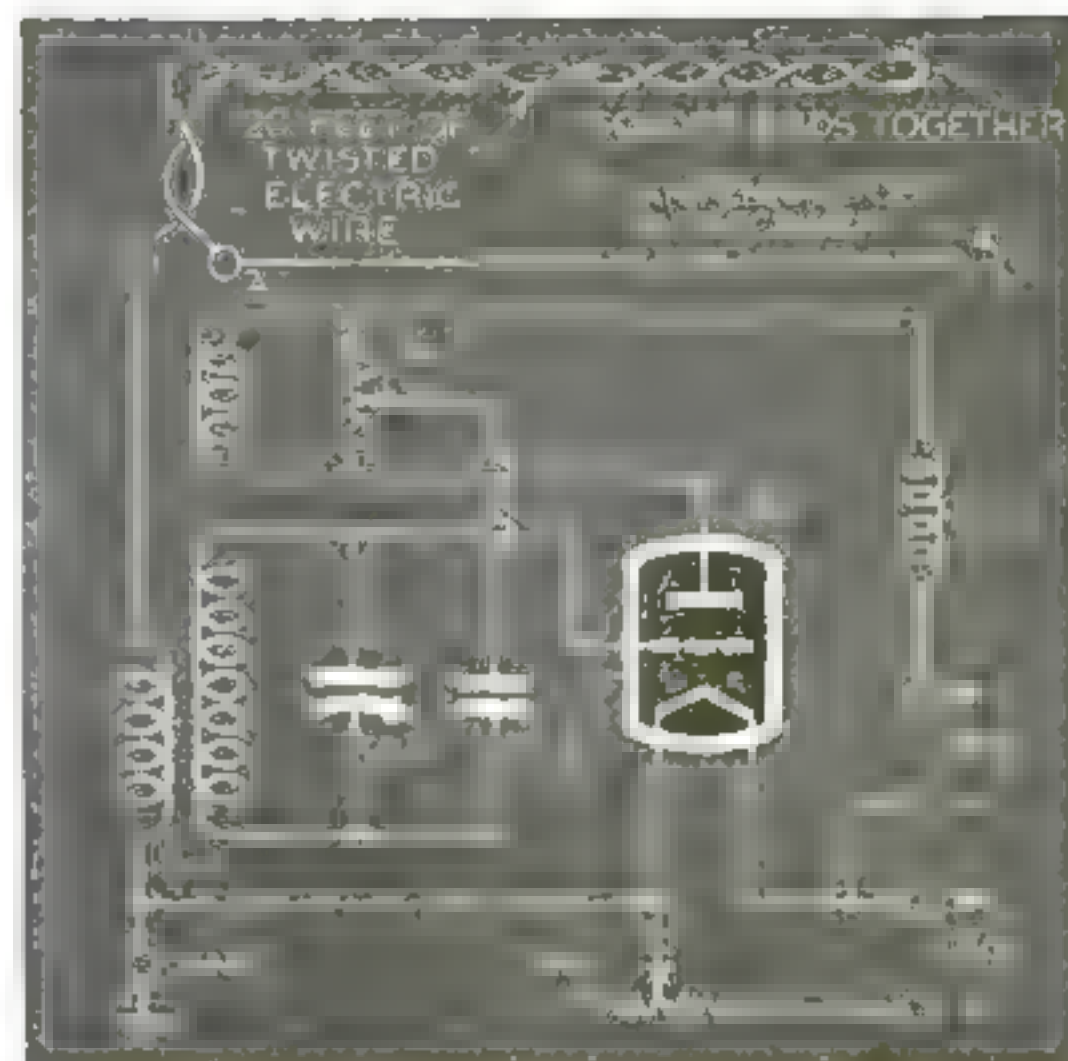
Unit Steps Up Battery Voltage

HIGH-VOLTAGE current for home receivers can now be obtained from an ordinary six-volt storage battery with a compact power-supply unit recently introduced. Replacing bulky "B" batteries, the handy outfit employs a vibrator circuit of the type used to power most automobile receivers. Providing a choice of voltages from twenty-five to 110 volts, the unit can be used for any purpose where high voltage must be obtained from a storage battery.



A new lamp may be inserted from the front.

EASILY BUILT Signal Booster IMPROVES YOUR RECEIVER



Low-power stations can be brought in with good volume when this auxiliary unit is used. It is inexpensive to build, and the circuit, shown at the right, is easily wired

GOOD volume, even on the weaker signals, can be obtained with an inexpensive receiver if it is equipped with this simple, easily built signal booster. In large cities, the auxiliary unit helps to obviate the blanketing effect of tall, steel buildings, and enables you to tune in clearly on any of the crowded, low-power stations. Designed to add the advantages of regeneration to superheterodyne and tuned-radio-frequency sets, it cannot, of course, be used with any set that already oscillates.

The parts required are few, inexpensive, and easily obtained. Regeneration control is provided by a 50,000-ohm potentiometer; tuning by a .00014 mfd. variable condenser. The two coils, commercial, six-prong broadcast units, have three windings: antenna, grid, and tickler.

Because of the simple construction, no separate chassis is needed. The bakelite sockets for the tube and the coil are mounted directly on the bottom of the 4 by 5½ by 6-inch cabinet, which is made of aluminum, one-sixteenth inch thick. A piece of cardboard will serve to insulate the sockets and wiring from the metal.

The special doublet antenna consists simply of a twenty-foot length of lamp cord, with the wires at one end soldered together. The free ends are attached to the antenna binding posts (A-A) of the booster.

Although the filament voltage of the '30 tube is rated at one and a half volts, it may be necessary to increase this to about 1.8 volts if the set fails to oscillate.

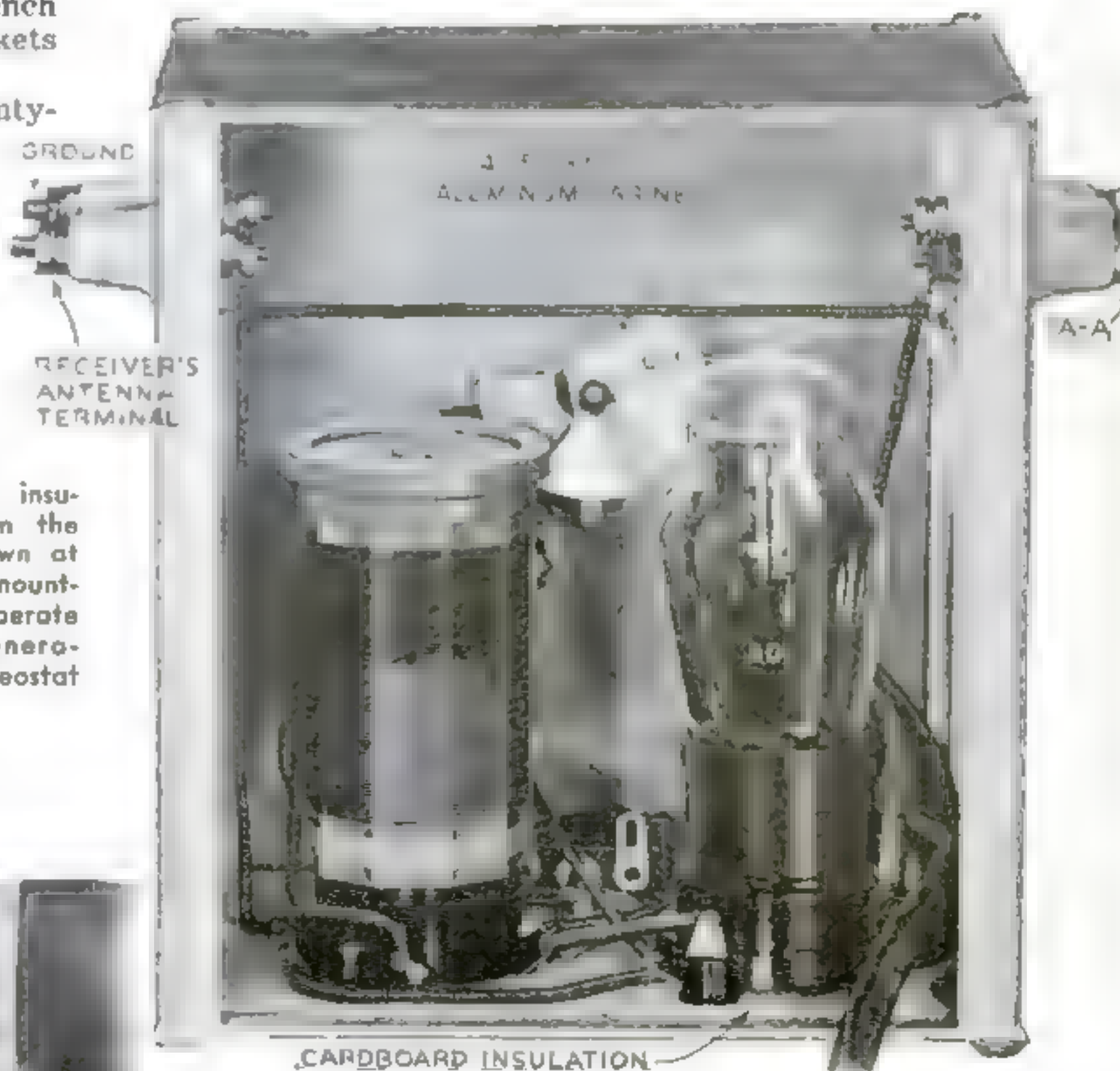
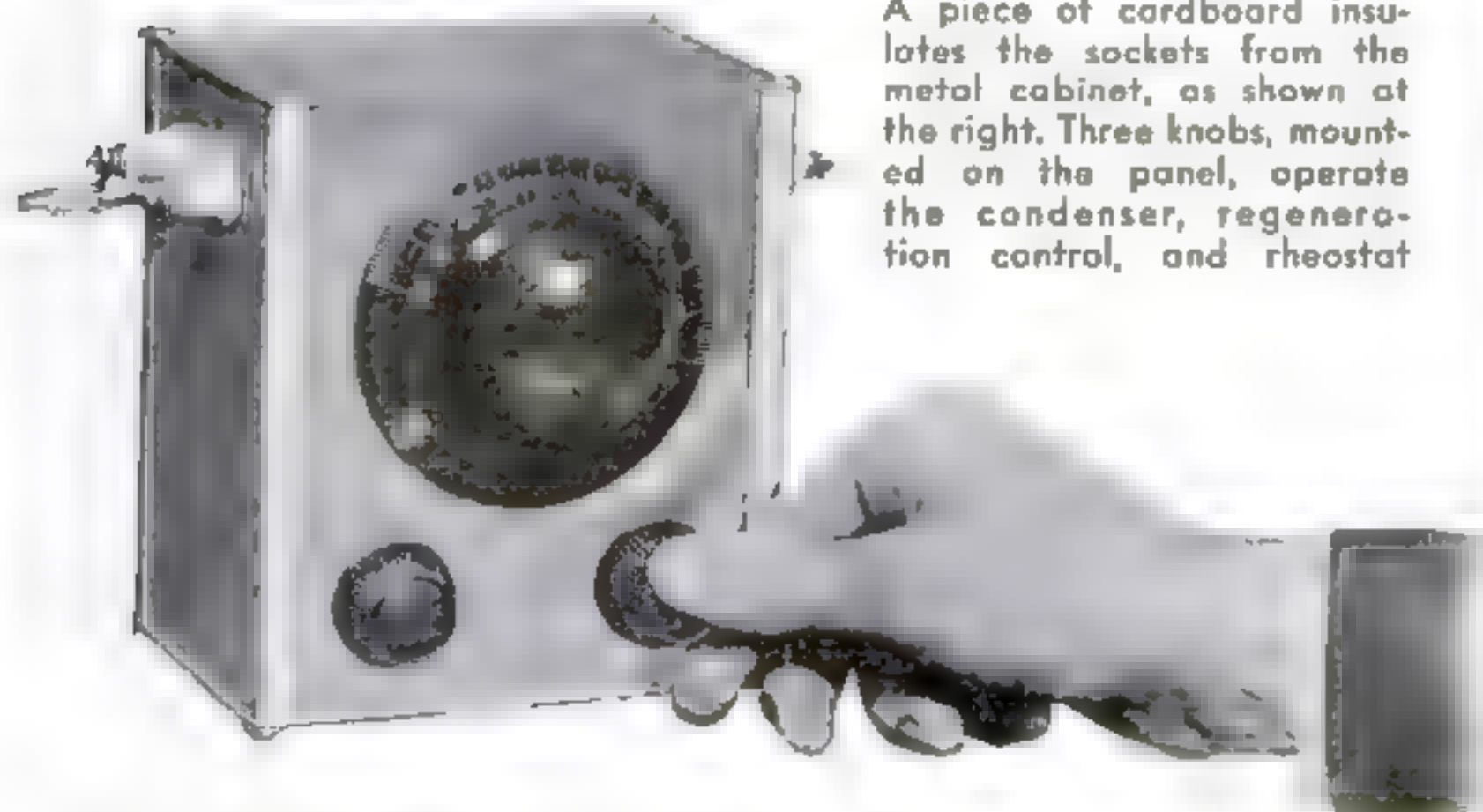
To connect the booster to your broadcast receiver, detach the regular antenna and ground leads from the receiver and run a piece of wire less than two feet long from the antenna terminal to the one provided on the booster. The remaining booster terminal is wired to a ground.

The unit is operated in a manner similar to that of a simple regenerative receiver. First of all, the 50,000-ohm potentiometer should be adjusted until the circuit is just on the verge of oscillation. A station then can be selected on the main set, and the booster tuned.

The parts required for the signal booster are as follows: C₁.—Variable condenser, .00014 mfd.; C₂.—Fixed condenser, mica, .00025 mfd.; R₁.—Rheostat, 30 ohms; R₂.—Volume control, potentiometer, 50,000 ohms; L₁.—Plug-in coils, broadcast band, six prong; CH.—Radio-frequency choke, 20 millihenry; Cabinet, sockets, tube, batteries, etc.

By Thomas Maguire

A piece of cardboard insulates the sockets from the metal cabinet, as shown at the right. Three knobs, mounted on the panel, operate the condenser, regeneration control, and rheostat



"Here, take a look at this," said Gus, picking up a discarded battery plate. "You can see that it is just a lead grid stuffed with active chemicals."



What's Inside Your Battery?

YOU win, Gus," said Joe Clark, sticking his head out of the Model Garage office. Gus Wilson, his partner and the mechanic of the business, looked up questioningly from the workbench where he was tinkering with a carburetor.

"Remember when we fixed that short circuit in Evan Walsh's car and you tried to sell him a new battery, but the price scared him off?" Joe asked.

"Yeah," agreed Gus nodding. "And I bet you a dollar to a bum tire he'd go to that gyp battery store down the street and get stuck with a jerry-built job, and finally end up on the end of a tow rope."

"Well, that's just what's happened," Joe laughed. "He's on the phone now, mad as a hornet. The car's stuck out on the road, just this side of Peyton's Corners. Can you go out after him?"

Gus muttered to himself as he wiped his hands on a wad of waste. "He would pick a busy day," he said, finally. "Tell him I'll be out in a quarter of an hour."

When the tow car pulled up at the roadside in front of Walsh's blue sedan, the car owner was leaning against a fender and chewing viciously on a long, black cigar. "That's a fine job of wiring you did for me," he growled by way of greeting. "Drained the juice right out of a brand-new battery."

"We'll see about that when we get back to the garage," Gus replied cheerfully, as he looped a rope around the car's front bumper. "Hop in and we'll get going."

Back in the Model Garage shop, Gus lifted the car's floor boards to uncover the dead battery, and disconnected the

cables. "First of all," he said, "we'll just check that wiring job." Running wires from a test battery to the loose cables, he motioned the customer to watch a meter standing on the bench.

"Do you see any reading on that meter?" he asked. "If there's a leak in the wiring, it will show there."

Walsh shook his head in bewilderment. "No, it looks all right from that angle. But if the wiring is O.K., what could be the trouble?"

"The trouble," Gus replied with a jerk of his thumb, "is in that pile of junk you let somebody sell you for a battery."

"Don't try to tell me that isn't a good battery," snapped Walsh, tilting his cigar at an aggressive angle. "The salesman weighed it for me. It was even heavier than a standard make. That shows it hasn't got undersize plates, like some of these cheap jobs I've heard about."

Gus smiled. "So you bought a battery by weight, did you? It would make things a lot easier if that was all there was to building a good battery—making it heavy."

"Well, it gave a good, hot spark when he snapped a wire over the terminals," sputtered Walsh.

Gus's smile became a broad grin. "No matter how poor a battery is, it'll make a nice, fat spark if it's got any charge at all. As for weight, let's take a look." He reached in a drawer and pulled out a small, black book.

"These are the specifications for batteries worked out by the Society of

Automotive Engineers," he explained, wiping a broad, greasy thumb on his overalls, and pointing out a column. "Notice that it doesn't say a thing about weight."

"But it's the lead in a cell that stores up the current," Walsh objected. "The more lead there is, the more the battery will weigh. So the heavier it is, the better."

"You're confusing metallic lead with lead compounds," explained Gus, reaching beneath his battery-charging stand.

"Here, take a look at this," he continued, picking up a discarded battery plate. "That plate is just a lead grid stuffed with active chemicals. It stands to reason that if you make the grid heavy and coarse, the battery will weigh more, but it won't hold so much active material."

"Then a good battery is one with a very fine grid?" put in Walsh as he examined the plate with interest.

"It's not as simple as that," Gus countered, warming up to his subject. "If the plates are too thin they're no good, either. They buckle too easily."

"And that's not all," he continued, holding up a thin wooden plate separator. "These spacers between the plates have to be able to take it. If they break down, the plates will short-circuit against each other. And that'll be the end of the battery."

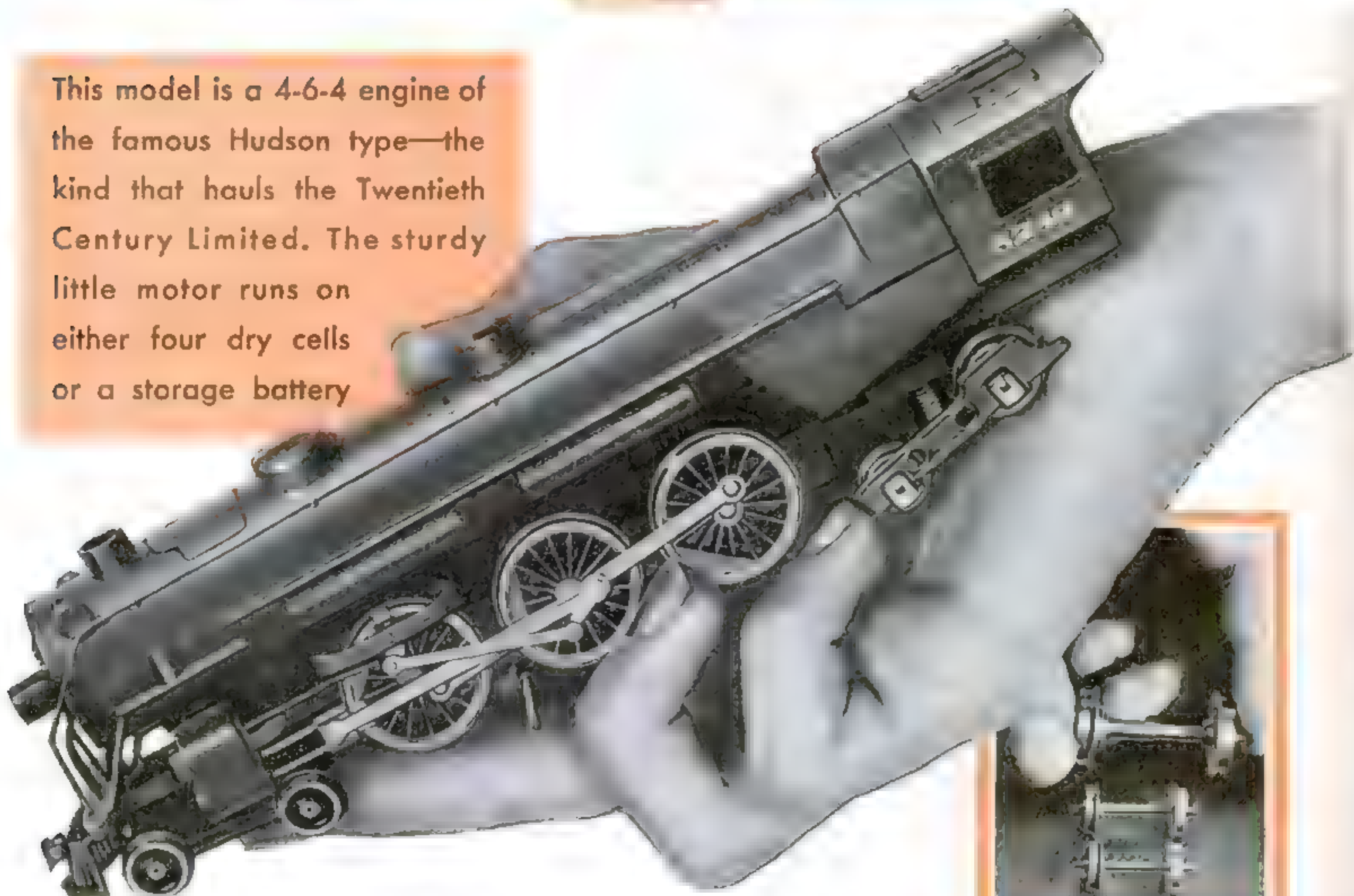
"Then there's still another thing. The active chemicals must be pure. If they're not, there'll be a steady loss of current within the battery itself."

"Even a good battery," he went on, as he threw the old battery plate and separator back into the scrap heap below the bench, (Continued on page 141)

By MARTIN BUNN

THE HOME WORKSHOP

This model is a 4-6-4 engine of the famous Hudson type—the kind that hauls the Twentieth Century Limited. The sturdy little motor runs on either four dry cells or a storage battery



HERE'S A SIMPLIFIED

Locomotive Model

YOU CAN BUILD ON A KITCHEN TABLE

RACING through the night on its 961-mile, sixteen-and-a-half-hour run, the Twentieth Century Limited symbolizes swift and sure transportation wherever its name is known. Much of the credit for the train's dependable operation is due to the massive, Hudson-type locomotives introduced on the New York Central Lines. It is a real thrill to see one of these throbbing monsters fly past, hauling a solid train of Pullmans at seventy or better, and the fascinating scene is one you can reenact at any time—if you are a model railroader.

In the past, the building of a realistic model of such a locomotive always has been difficult for a beginner. A high degree of skill was needed to make the tiny parts, and expensive tool equipment was required. This new design

eliminates the troubles that formerly have barred many hobbyists who were anxious to break into model railroading.

Anyone who can handle a soldering iron, tin snips, hand drill, and pliers can do the work. The tools are the kind to be found in every workshop. No lathe or drill press is needed. However, if you have a power drill, it will speed up the work, while a metal-turning lathe will enable you to make a few parts that you would otherwise have to buy.

Even the materials have been kept to a bare minimum, as you will see by referring to the itemized list at the end of this article. For example, only two

thicknesses of sheet metal are required, along with a few strips of brass bar, rod, and tube. The manufactured parts that must be bought are few and comparatively inexpensive—mainly the wheels, motor, and gears.

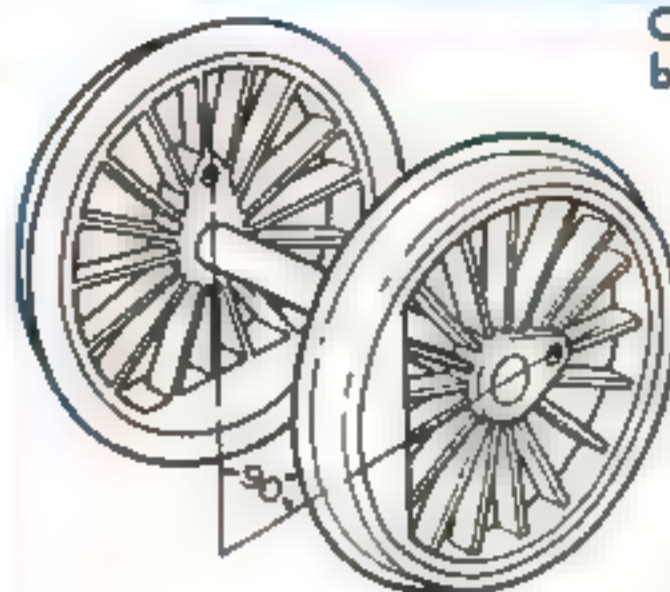
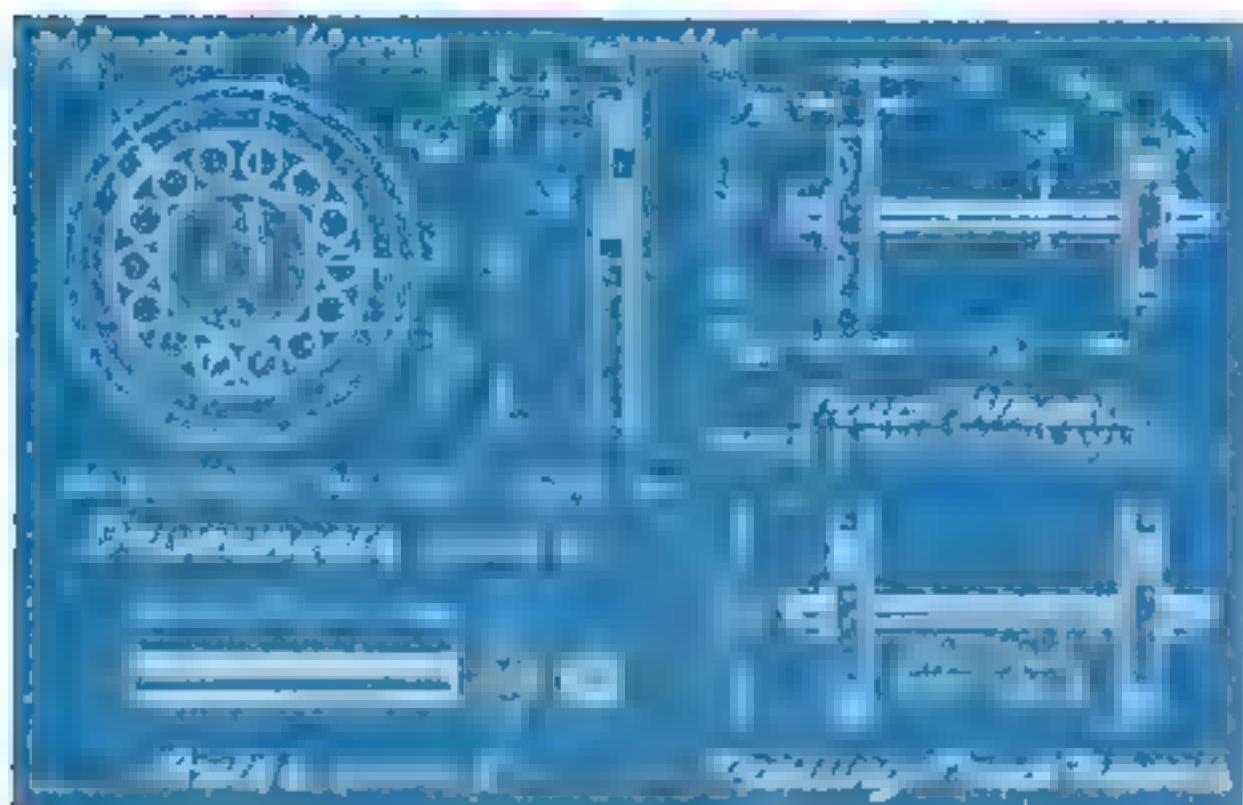
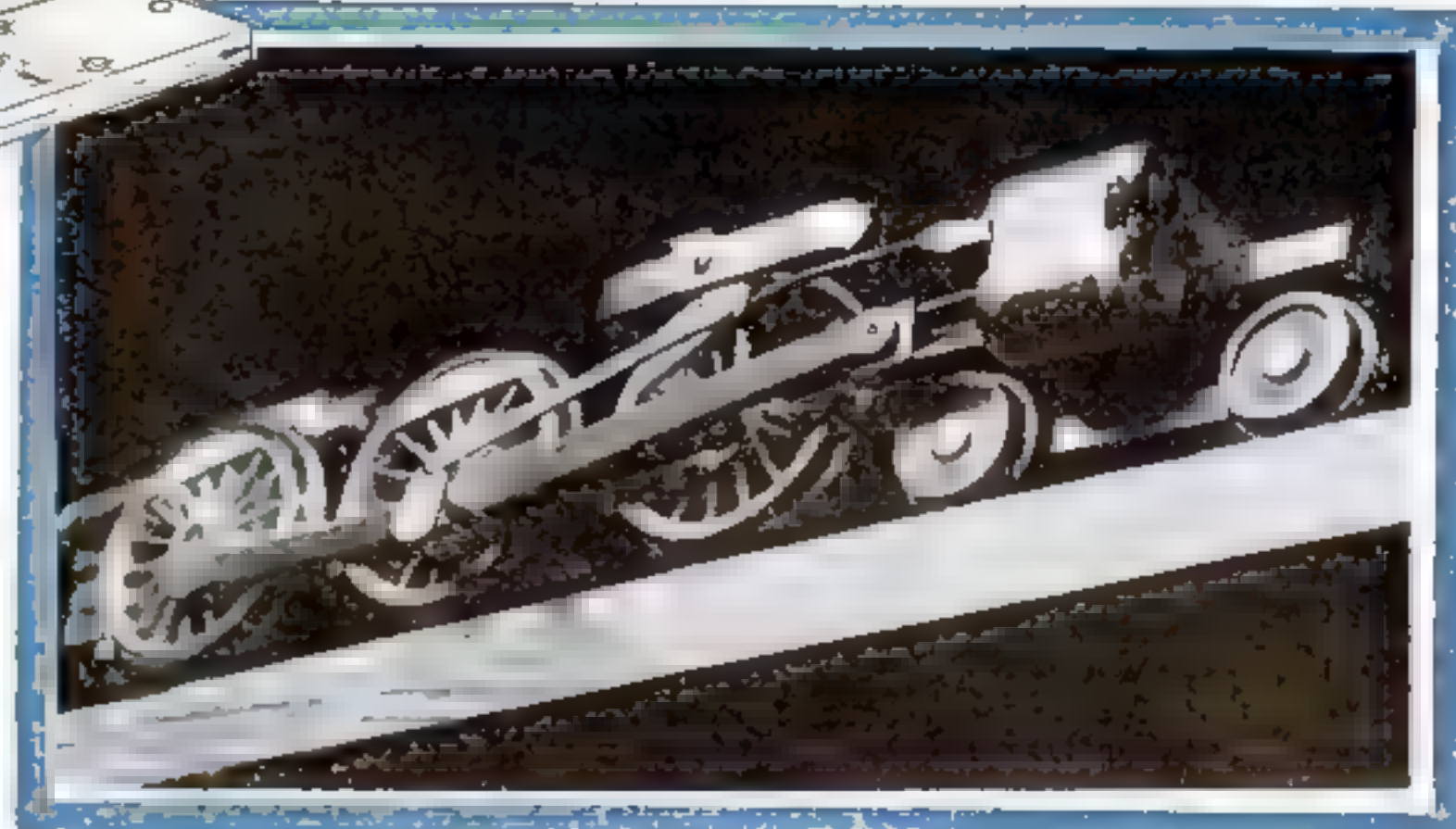
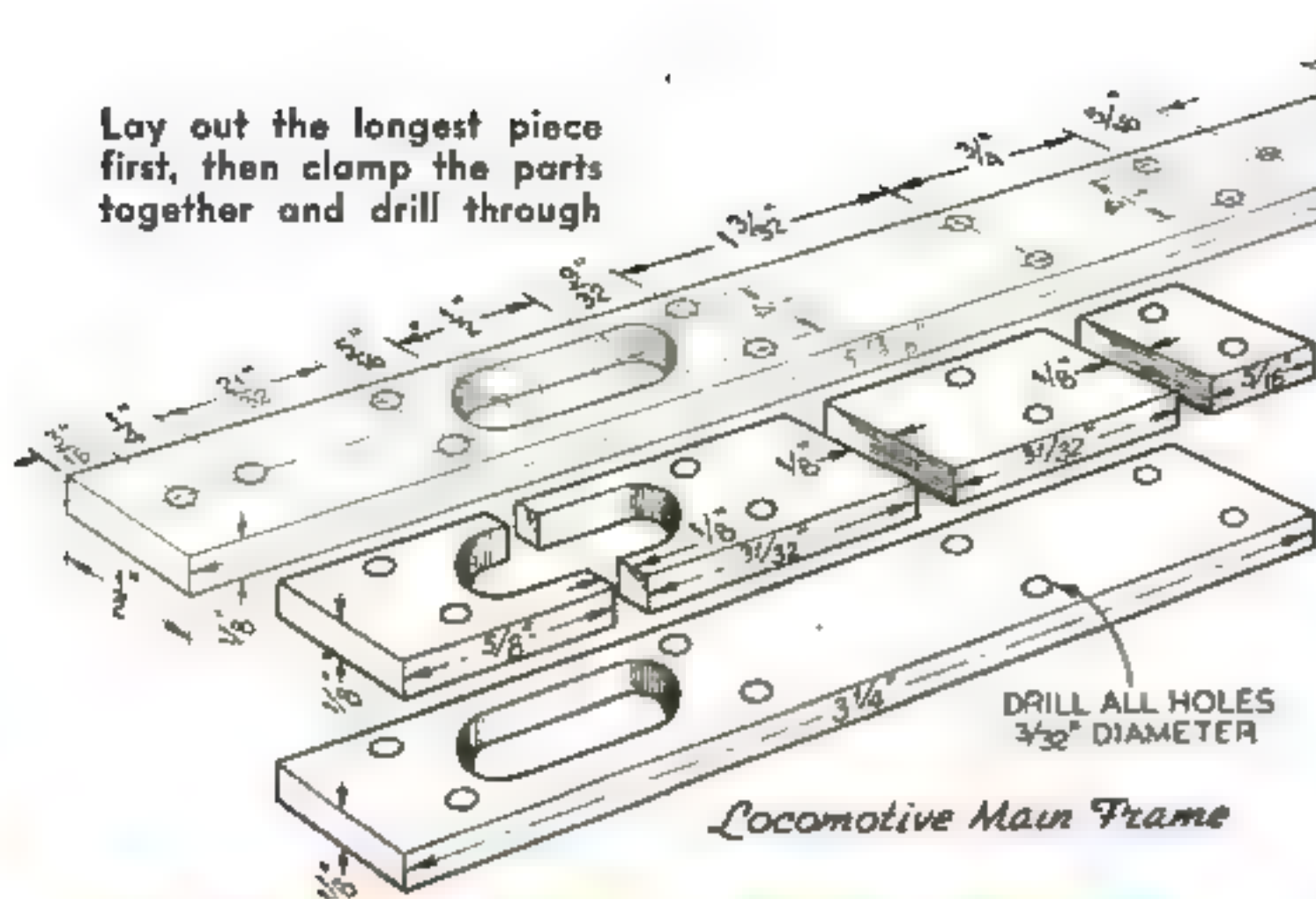
The locomotive is built to run on HO-gauge track, smallest of the three popular model-railroad scales. This is 16½ millimeters, or approximately ⅝ in. between the inside edges of the running rails. The familiar O gauge is 1¼ in., while OO gauge, which often is confused with HO, is ⅜ in. The relationship of the three sizes is graphically shown in one of the accompanying photographs.

Actually, in building HO equipment, 3½ millimeters on the model equals 1 ft. of the original, or prototype, to use the term favored by model makers. That

By

HAROLD V. LOOSE

Lay out the longest piece first, then clamp the parts together and drill through



Completed valve gear. The parts are shaped from brass and assembled with small escutcheon pins

of the holes with a scribe and center punch, then clamp the parts together and drill through all three thicknesses at once, to assure alignment. As each hole is completed, add the 2-56 screw and nut called for in the assembly drawings—these will help keep the parts aligned. The large slots are made by drilling two 1/4-in. holes and removing the metal between with a coarse, round file.

The wheels are commercial model-railroad parts, but if you have a lathe, you may wish to make your own, modeled after the latest disk types used on real railroads, as suggested in one of the drawings. Press the driving wheels on their axles, and assemble in the square holes provided for the purpose in building the frame. Bearings of this type, although unconventional, are long-lived, and the corner pockets hold the lubricant just where it is needed.

Note how the wheels are quartered. This means that the crankpin holes of opposite wheels are at 90 degrees to each other. When the crankpins of the right-hand wheels are at the bottom, the ones on the left-hand wheels point forward.

If your model is to be electrically

If a lathe is available, you can make wheels as shown above. They are pressed on axles

makes this particular locomotive 14 in. long, including the tender. Passenger cars are approximately 11 in. long, and freight cars, 6 in. All dimensions will be given

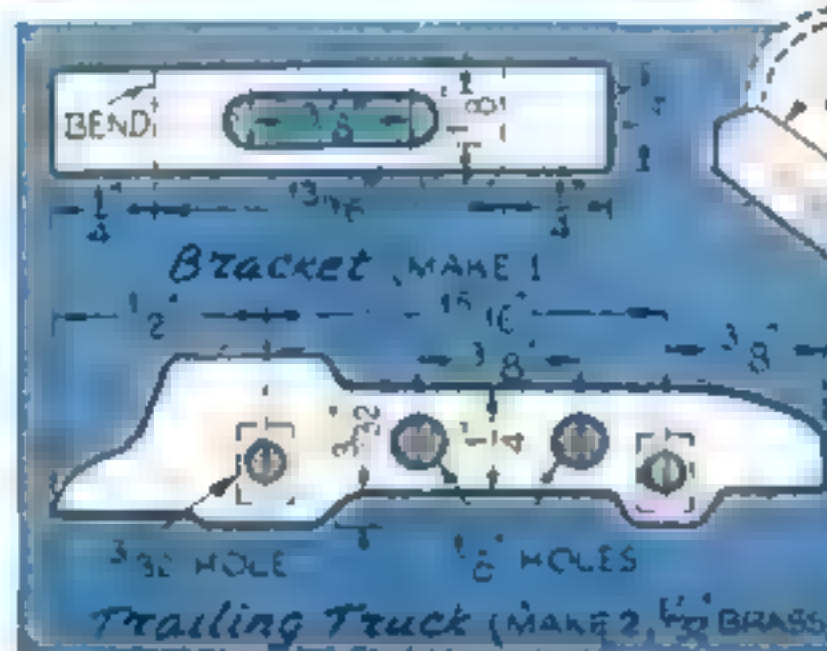
in inches for the convenience of readers not accustomed to using the metric scale.

The outstanding advantage of this gauge, besides its low cost, is the fact that you can put your track layout in a space that would be far too small for the larger O gauge. Track curves can have as short a radius as 2 ft. although 3 ft. is better. You can, indeed, lay out a whole railroad system on a large table, such as one used for playing table tennis.

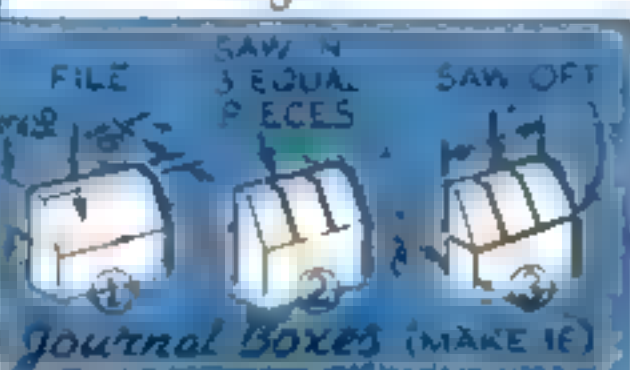
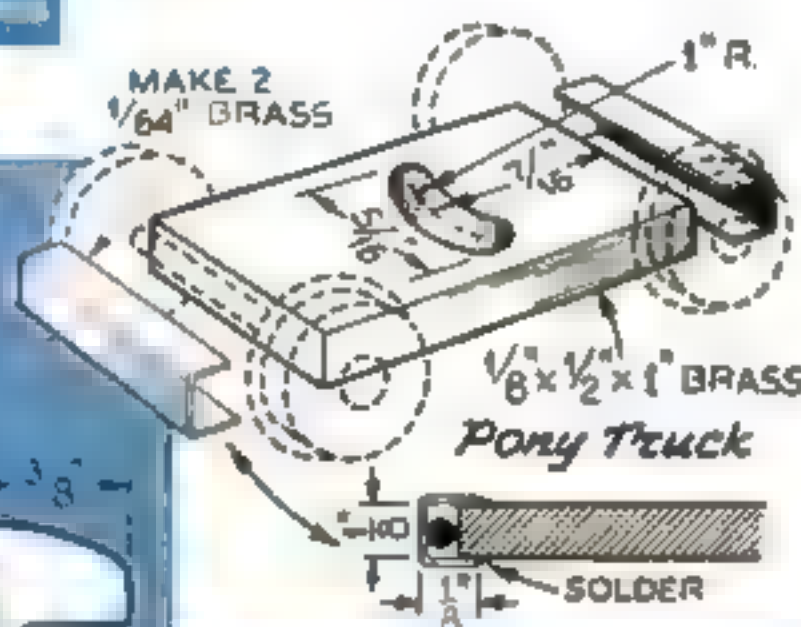
Of course, if you do happen to have ample room for setting up the road, the small scale remains advantageous because it enables you to arrange a long and realistic run of track, with plenty of distance between stations.

Contrary to first impressions, it is not necessarily more difficult to build the smaller locomotives and cars. In some respects it is easier, because so many of the smaller parts can be simplified and still look sufficiently realistic.

The motor used to power the model is of the permanent-magnet type, and operates on six volts, direct current. This means that it can be reversed simply by flipping a switch on the control



Parts for trailing truck, method of assembling pony truck, and steps in making the journal boxes

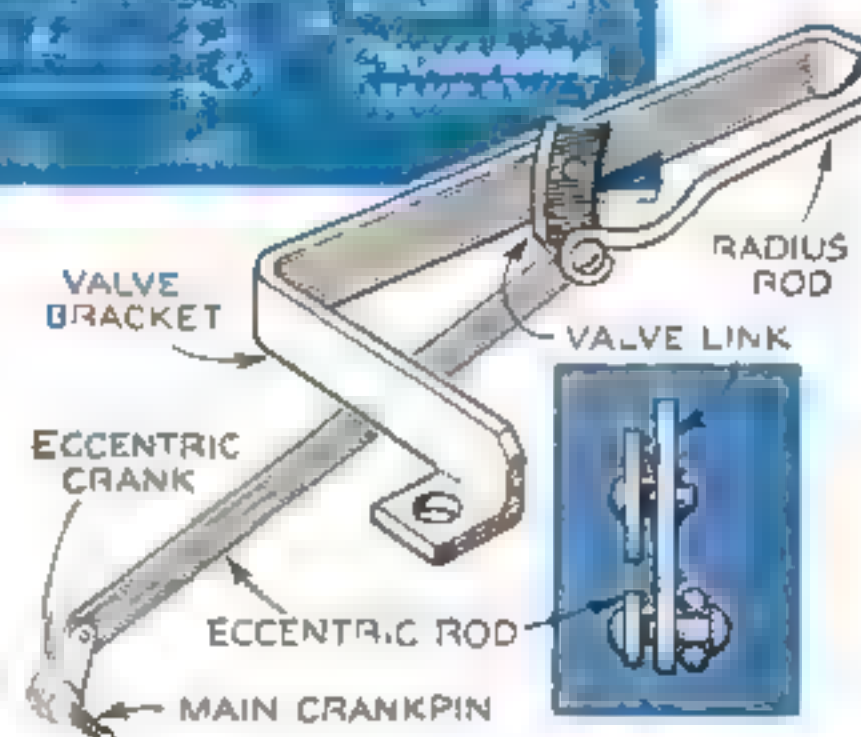


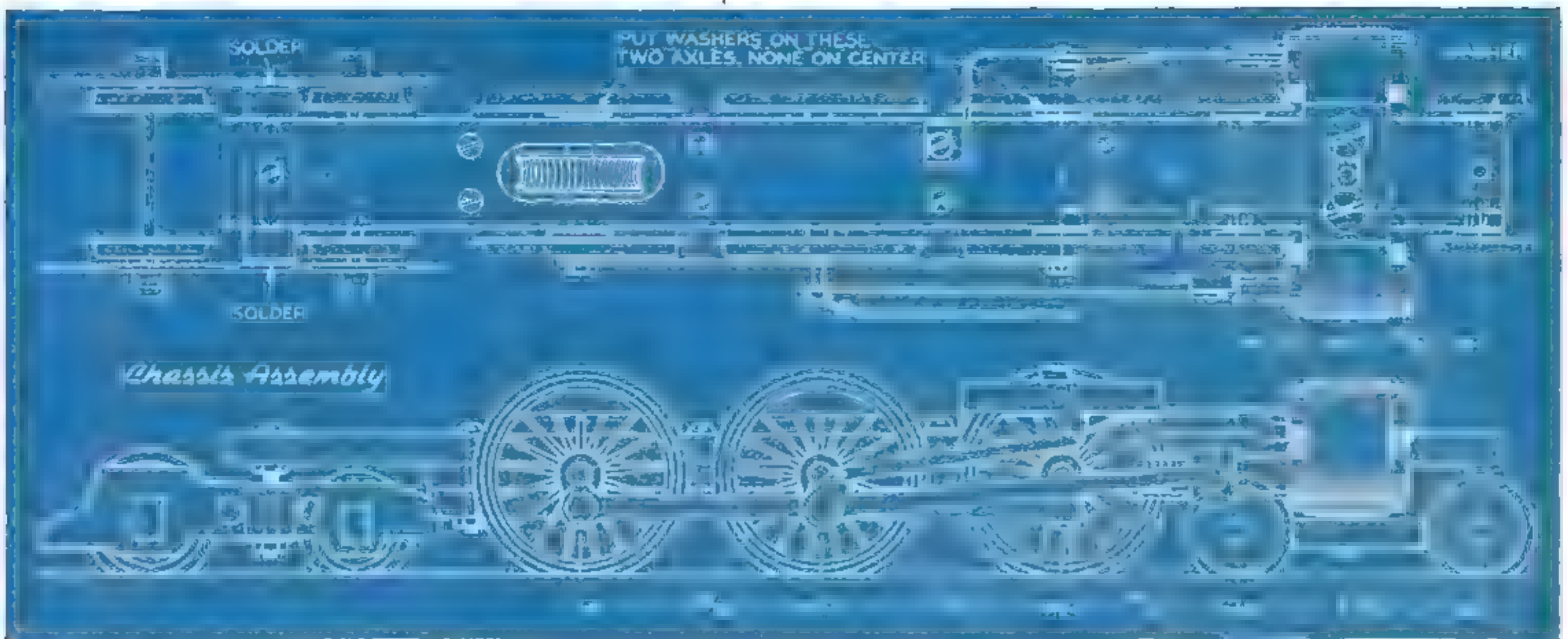
panel of your model railroad, no matter where the locomotive is. In connection with the automatic couplers that are available for HO gauge, this feature makes it possible for you to carry on elaborate switching operations, breaking up trains, coupling and uncoupling cars, and running the rolling stock into sidings, just as if the train were manned by a tiny engineer and brakeman.

Construction begins with the frame. Saw lengths of 1/8 by 1/2-in. brass to the dimensions shown, squaring the ends carefully with a file. On the longest piece, mark off the location



Valve-gear parts and how they are bent and assembled. Note how the radius rod is looped around the head of the same escutcheon pin that passes through the valve link and end of eccentric rod





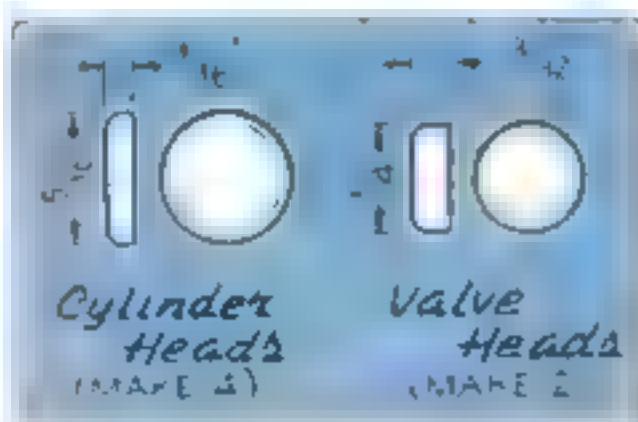
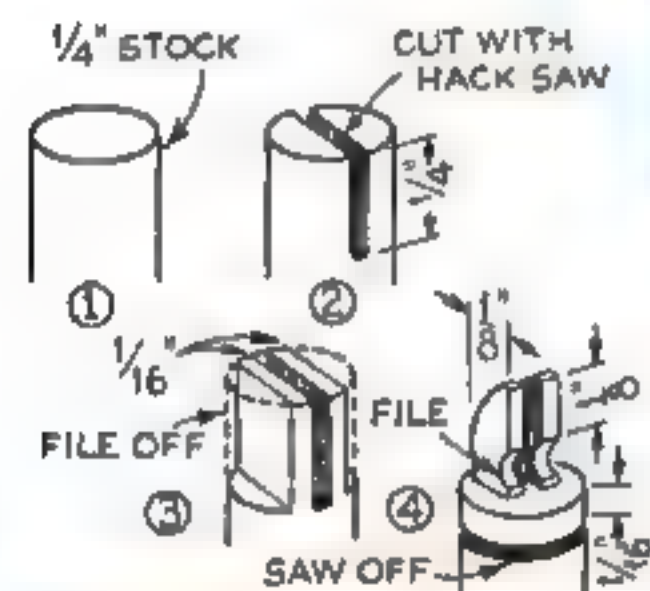
How the chassis is put together. All straight mechanical drawings on these pages are full size

driven, put the worm-drive gear on the rear axle at this time. The balance of the motor drive will be discussed in a later installment.

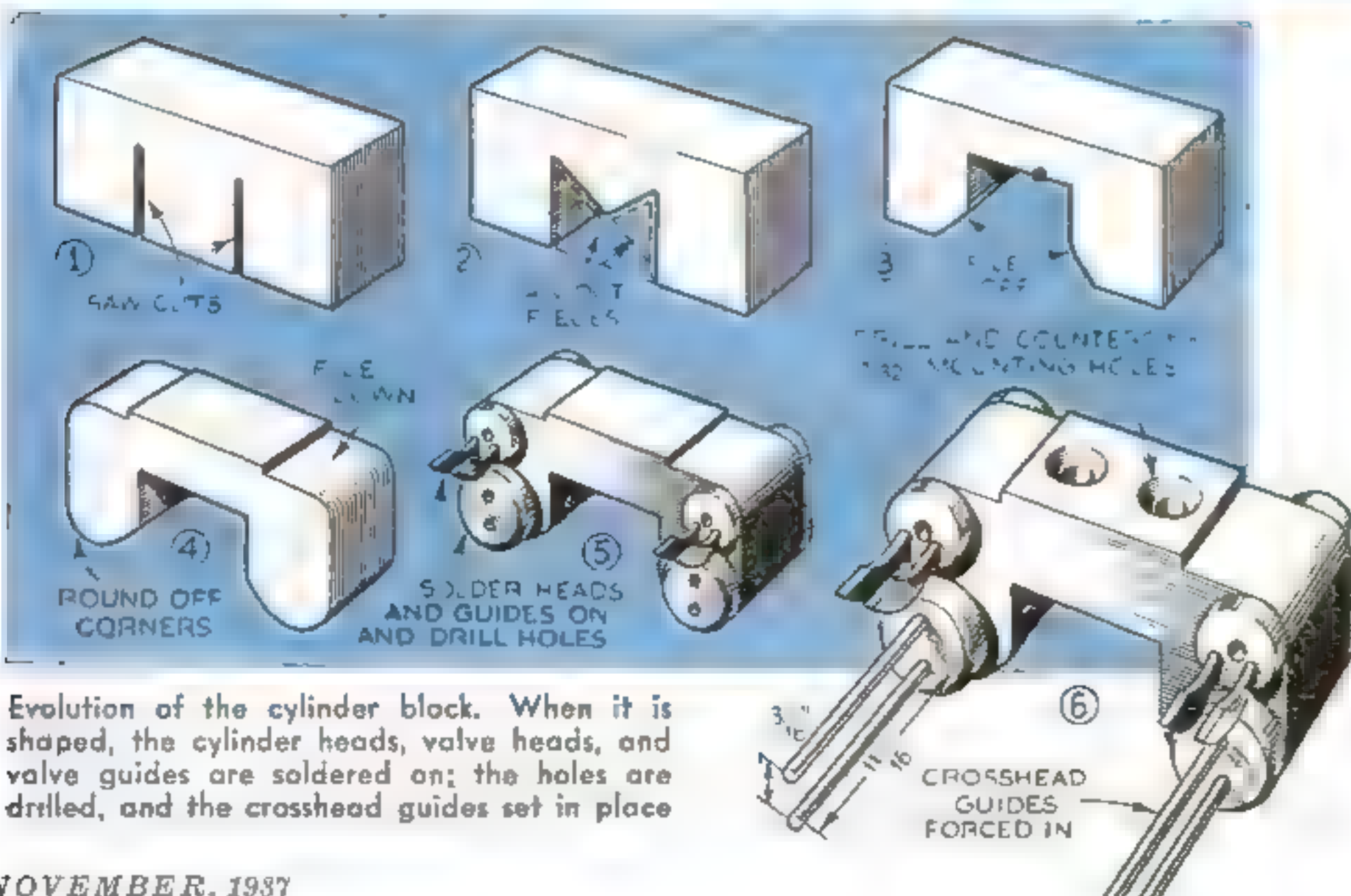
Saw and file the cylinder block to shape from a piece of $\frac{3}{8}$ by $\frac{5}{8}$ by $1\frac{3}{8}$ -in. brass, as shown in the drawings; then make the valve guides, cylinder heads, and valve heads. The latter parts are made, in the absence of a lathe, by taking a length of brass rod in the right hand and pressing it against a piece of emery cloth held in the left. Rotate the rod, and the emery cloth will round off the corners almost as well as a lathe could do.

Soldering these parts calls for a good-sized sol-

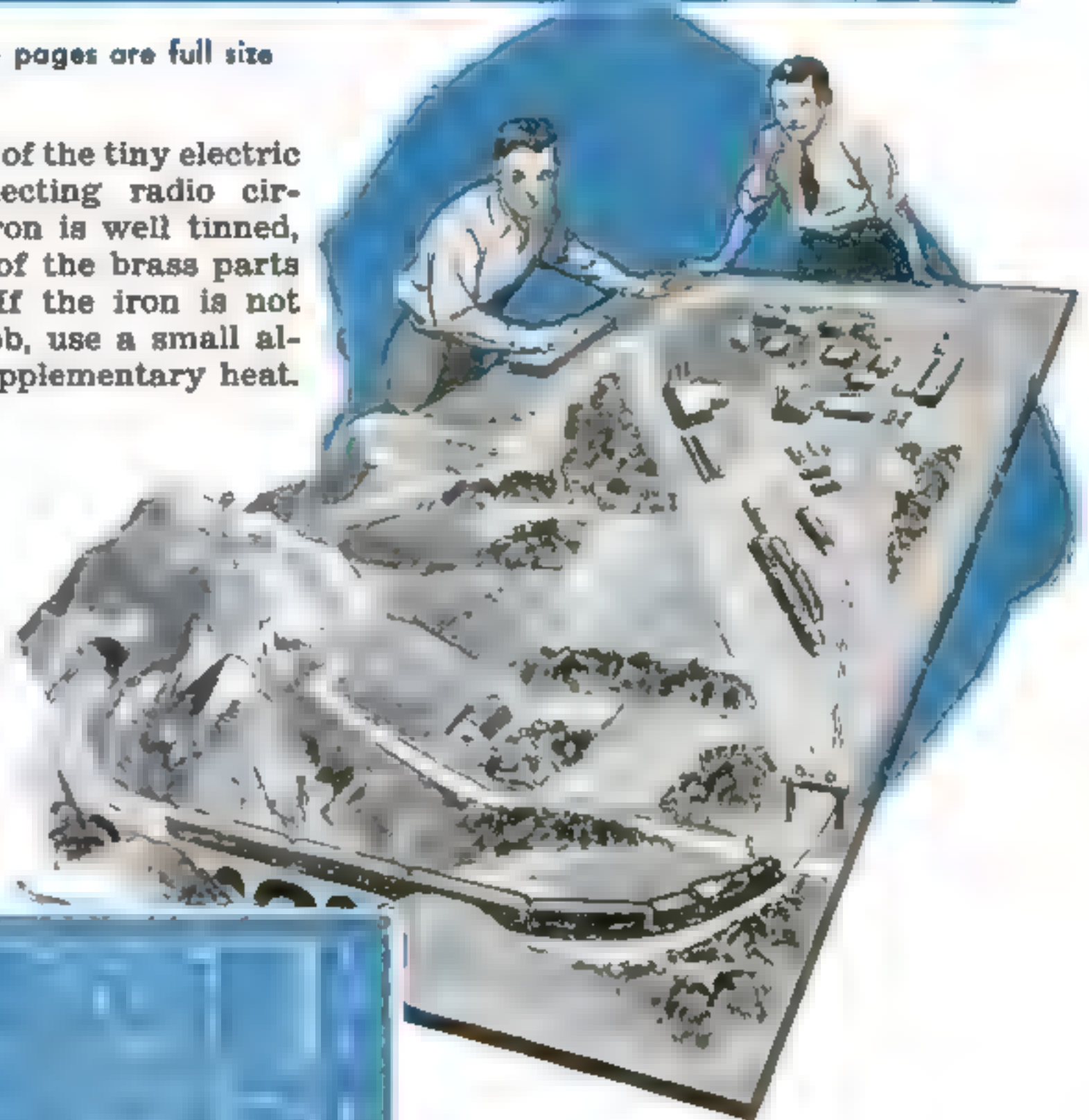
dering copper, not one of the tiny electric irons used for connecting radio circuits. Be sure the iron is well tinned, and tin the surfaces of the brass parts before assembling. If the iron is not big enough for the job, use a small alcohol torch to add supplementary heat. Some of the parts may tend to melt off while others are being soldered, but this may be prevented by wrapping them with damp rags.



Left, the operations in making the valve guides. Above, details of the cylinder and valve heads. Right, the cylinder block



Evolution of the cylinder block. When it is shaped, the cylinder heads, valve heads, and valve guides are soldered on; the holes are drilled, and the crosshead guides set in place



The side rods, main rods, and valve-gear parts are cut and filed from $\frac{1}{32}$ -in. sheet brass. Make sure the distance between the holes in the side rods corresponds exactly with the actual wheel base of the chassis, or the parts will bind.

Assemble all parts of the valve gear, and bolt the bracket to the frame; then solder the eccentric cranks to the main crankpins at the angle shown in the drawing. It may take a little experimenting and adjusting to get these parts working freely, therefore do only one side of the engine at a time. Then if something catches you know where to look.

The valve brackets and any other parts of the locomotive that must be bent sharply should be annealed. This is done by heating the brass red-hot, then plunging it into cold water.

The pony truck is of a novel design that has proved very practical in service. It is simply a length of $\frac{1}{8}$ by $\frac{1}{2}$ -in. brass with two thin sheet-metal brackets looped over the axles at the ends. These (Continued on page 136)

Better Signs

Using jig-sawed letters to get increased visibility... Painting methods and colors

By
**RALPH G.
WARING**



Folding orchestra stand with letters cut from birch plywood and painted before being fastened to the panel

COLOR is of paramount importance in making a sign effective in catching the eye. The general attractiveness, of course, is dependent upon the treatment of the subject matter, the arrangement of the lines, the relative value of the color masses, and the "eye appeal" that the ensemble exerts upon the passer-by. Omit a careful study of any one of these items in their relation to the whole, and the entire sign loses its effectiveness in just that proportion.

If, for example, you are the owner of a greenhouse dealing with the wholesale trade almost entirely, you will want one type of sign, but if you sell to a constantly changing retail trade of high-class home owners, your appeal should be entirely different. In any case, there must be some feeling of consistency between the type of sign used and the surroundings. It is obviously out of place to use a very new, ornate, and colorful sign to attract customers to a place of business where the buildings are out of repair and badly in need of paint.

Again, if passing traffic is rolling on a highway rather than on a more leisurely lane, visibility is a factor that



Applying the first coat of metal primer to jig-sawed aluminum letters, which are temporarily supported on a scrap board

cannot be ignored. This was proved most effectively in designing the portable florist's sign illustrated. First an ordinary one-stroke brush letter was used on this panel, and it gave a visibility of but 50 ft. from a fast-moving auto. Then the letters were jig-sawed from 20-gauge scrap aluminum sheet obtained from an auto-body works, and

mounted on 5/16-in. diameter wooden dowel pins, cut 1 in. long and center-drilled for a roundhead 1½-in. No. 4 screw. Enough of these pins were used with each letter to support it solidly. Actual tests then showed that this third-dimension depth increased the visibility in open sunlight to 200 ft. at the same speed. This meant that more people could and would read in time to stop their cars and turn in for flowers and plants.

The general design of the sign itself is well balanced to keep the weight at the bottom for the sake of stability. Furthermore, a screw eye on the lower rear edge is dropped over an anchor pipe containing holes to receive a padlock.

Since the sign is exposed constantly to all kinds of weather, only the best grade of outside house paint was used. Three coats were applied, and each was allowed to dry hard.

The letters, after being cut out, were mounted on a scrap board as shown, given a coat of metal primer, dried, and then given one coat of four-hour black enamel. When the paint on the wood panel of the sign had completely dried, the letters were mounted by *(Continued on page 127)*



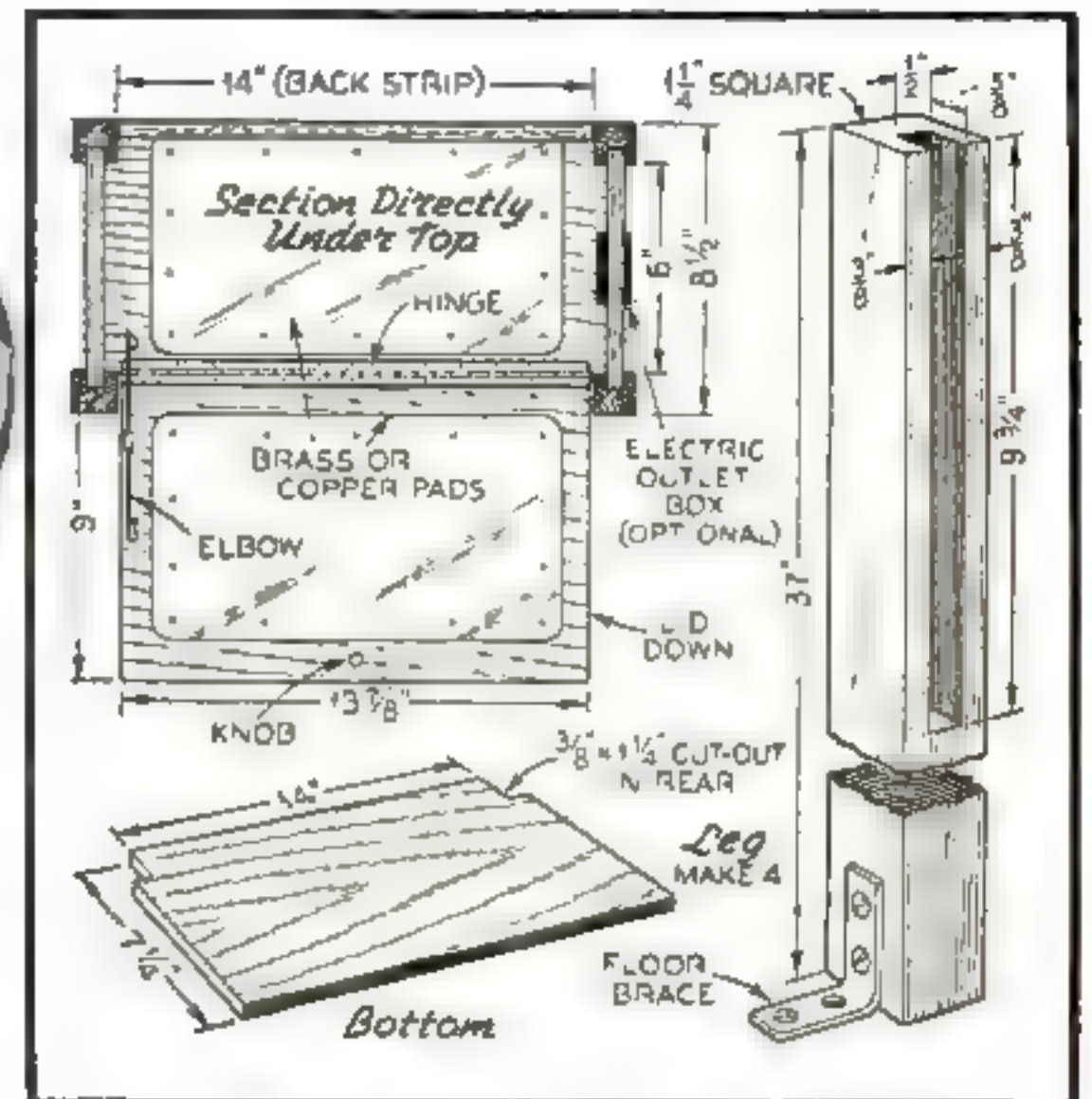
The letters of this sign were sawed from scrap aluminum and mounted on short dowel pins so they cast a shadow

Space-Saving Dinette Stand

HOLDS A TOASTER OR GRILL



Closed, the cabinet hides the electric appliance completely



Designed to fit over a radiator, the stand makes it easier to prepare and serve meals in a dining alcove or small apartment

IN A SMALL apartment where space is at a premium, this little stand fits over the radiator in the dinette and holds the electric toaster, grill, or other accessories. The dimensions may be altered.

First, rout or chisel out the four legs. Then glue and insert the two sides and clamp each unit together. Cut out the bottom and, when the glue is dry, nail it on through the sides. Except for a narrow strip along the bottom, the back of the case is left open so there will be plenty of air in circulation should the toaster be accidentally closed in with the current on.

Attach the hinge, which in this case was taken from an old radio cabinet. A 6-in. folding elbow or chain is fastened on one side to support the lid in the down position. The top is nailed directly on the four legs, overhanging 1 in. on all sides.

Set all brad heads and, after the priming coat of flat white has been applied, fill the holes with wood composition or putty; then enamel the whole.

Because this stand is comparatively tall and heavy at the top, it should be attached to the

floor by screwing four angle braces to the bottoms of the legs and to the floor. Copper or brass pads are added as shown.—CARL F. SCHRADER.

LIST OF MATERIALS

No. Pcs.	Part	T.	W.	L.
4	Legs	1 1/4	1 1/4	37
2	Sides	1/2	9 3/4	7 1/4
1	Lid	3/4	9	13 3/4
1	Bottom	3/4	7 1/4	14 1/4
1	Top	3/4	10 1/2	18 1/2
1	Back strip	3/4	1	14
2	brass or copper pads			
	28 gauge		6 1/2	12
	Four angle braces, 2 by 2 by 1/2 in.			
	Hinge, 13 3/8 in. long.			
	Folding elbow, 6-in.			
	28-3/8-in. No. 4 roundhead brass wood screws.			
	Glass knob for lid			
	Note: all dimensions are given in inches. The wood used in the original model is clear white pine.			

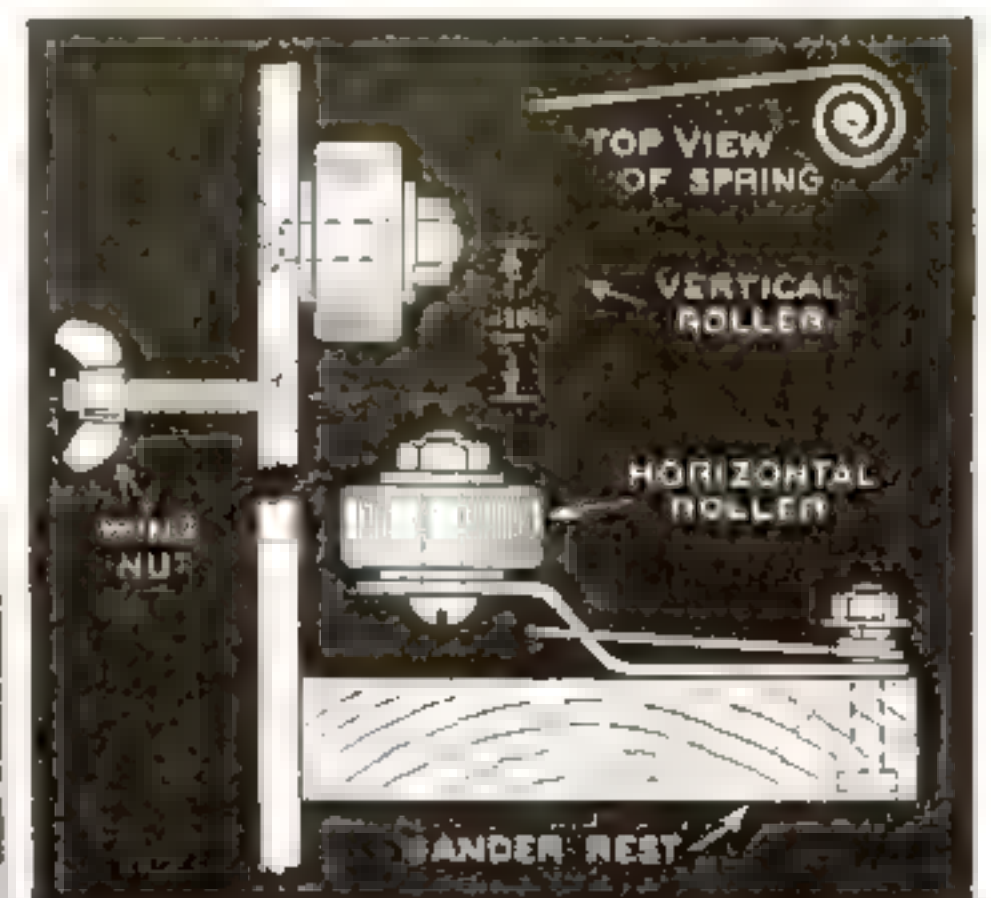
Roller Guides for a Disk Sander

AFTER a few narrow escapes from contact with a disk sander, I made the device illustrated. The wood is held both vertically and horizontally against the sanding disk by ball-bearing rollers.

Old roller-skate wheels will serve for the rollers. The vertical one is bolted to a piece of steel 7 by 3/4 by 1/2 in., which slides flush in a groove cut in the sander fence. A slot 1/4 in. wide is cut in the center of the groove to take the screw which holds the roller at any height.

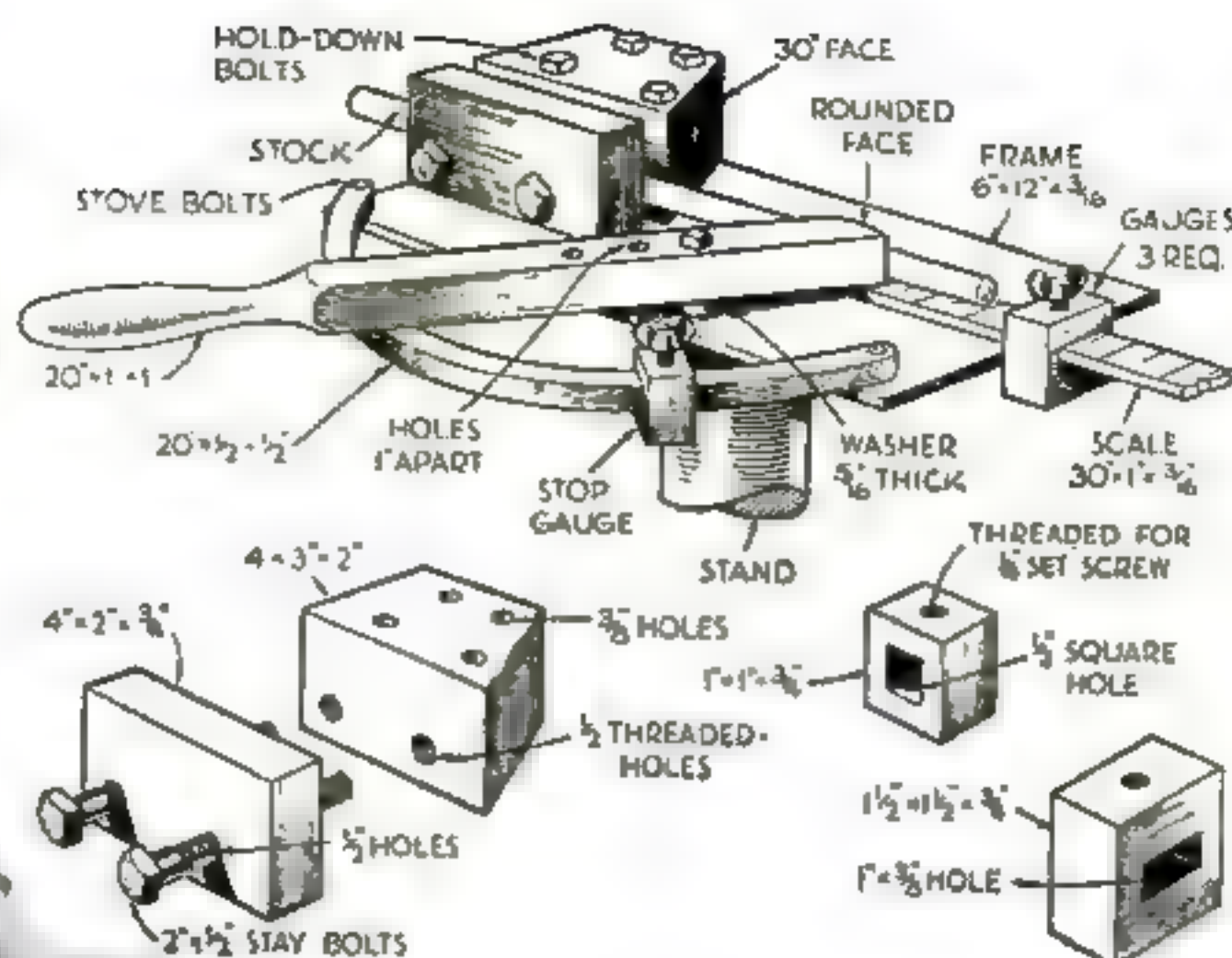
The horizontal roller is fastened to a bracket 1 1/2 by 1/2 in. and of sufficient length to reach from the edge of the rest to within 3/16 in. of the disk. The spring is wound from right to left, and the end is inserted in a hole drilled in the bolt. I found a discarded cone-type spring of 1/8-in. stock from a gas range door to serve this purpose. The square

head of the bolt is countersunk in the bottom of the rest so the bolt itself will not turn. For boards or work of extra large size, both roller devices may be removed.—HAROLD A. DEHN.



Holding small work on a disk sander. The vertical roller can be adjusted up and down by means of a slot in the fence. The other roller is pressed against the work firmly by a stiff wire spring

Constructed as sketched at the right, the bender is mounted on a stand or bench and used as shown below. It has gauges both for the length and degree of bend so that any number of duplicate parts may be quickly made



INEXPENSIVE Machine Bends Angles WITH ACCURACY

the natural springiness of various metals when bending angles.

The 5/8-in. pivot hole for the bending lever must be drilled 7 in. from the left-hand edge of the base plate and 1 in. from the front edge. The lever is made from 1-in. square shafting 20 in. long, with three holes to allow for adjustment. A washer 5/16 in. thick is placed under the lever to provide clearance between handle and gauge.

To make duplicate bends, a degree gauge is necessary. This is made of 1/2 by 1/2-in. iron bent into one third of a circle and bolted on the frame as shown. Another straight piece of 1 by 3/16-in. iron serves as the length and width gauge. Four stops are required for use on the gauges; these may be of cast iron as shown or made from any scrap stock on hand.

The completed bender should be securely mounted on a heavy stand or bolted on a workbench.—A. S. WURZ, JR.

BECAUSE of its rapidity, accuracy, and simplicity, a bender of the type illustrated will prove a timesaver for blacksmiths, tinsmiths, and ornamental ironworkers. If made according to the dimensions indicated on the drawings, it will bend any angle from straight to 145 deg. in wire and rods up to 1/2 in. in diameter and flat iron up to 1 by 1/2 in. Heavier or lighter models may be made to suit any requirements by making only a few changes in the design.

Cut the die blocks from any available cast-iron scrap as shown or have them cast at a foundry. Drill and tap them as indicated, and bolt the larger block to a plate 6 by 12 by 3/16 in. The reason the main die is cut at a 30-deg. angle is so as to overcome

Mystifying Stunt Makes Metal Melt Under Water

EXPERIMENTERS who have available several amperes of direct current at around 150 volts may perform the mystifying stunt of melting metals under water. In a vessel in which some ordinary washing soda has been dissolved, a strip of lead is immersed. This is connected to the positive wire of the supply line. The piece of metal to be melted is connected to the negative wire, grasped with a pair of heavily insulated pliers, and brought in contact with the water. It will quickly reach a white heat and melt. The heating is due to the igniting of hydrogen gas, which forms in minute bubbles on the metal connected to the negative wire.

Various kinds of metals may be melted, each burning with its own peculiar light, such as orange for steel, purple for brass, and green for copper. Five amperes of current are sufficient to melt a 1/8-in. rod.

Where heavier current is available, large pieces of metal may be brought to a white heat and welded together.—K. F.



The rod, if not too large, becomes white hot, then melts under water

A Heavy-Duty Drill for Work Outside the Shop

SO GREAT is the pressure it exerts, an ordinary post or blacksmith's drill eats through hard metals with surprising speed. It therefore pays, if much hard drilling has to be done outside the shop, to mount a heavy-duty drill of this type on a 4 by 4-in. timber about 3 ft. long so that it may be moved about. Nail two pieces of 1 by 10-in. board across the bottom of the 4 by 4-in. piece near the ends so that the whole may conveniently be blocked up in a horizontal position to any height required.

Mounted in this way, the drill will serve for many jobs that would be tiresome and time consuming to do by using a portable electric drill or a breast drill with chain attachment. The drill is

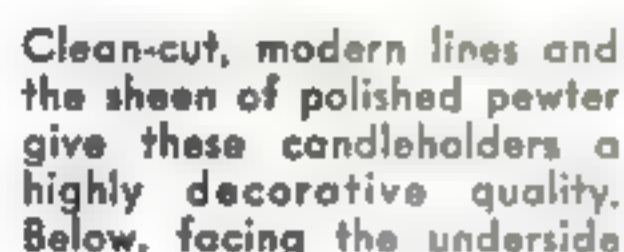
blocked up under the two transverse boards until it is the right height, and the adjustable table is set to back up the work. By this method I have drilled large I-beams, auto and truck frames, and other heavy parts that could not be handled on a drill press. Mechanics will undoubtedly find other similar uses for the drill.—STEPHEN SMITH.



An ordinary blacksmith's drill is bolted securely to a 4 by 4-in. timber and blocked up to suit the work, in this case a truck frame

TURNED FROM HOMEMADE PEWTER CASTINGS

Polish the holders with any suitable abrasive, such as No. 8/0 garnet sandpaper, thoroughly wet with light oil. Revolve the lathe at high speed and use enough oil to keep the paper completely wet. A piece of felt is cemented on the bottom of each holder.—D. C. MARSHALL.

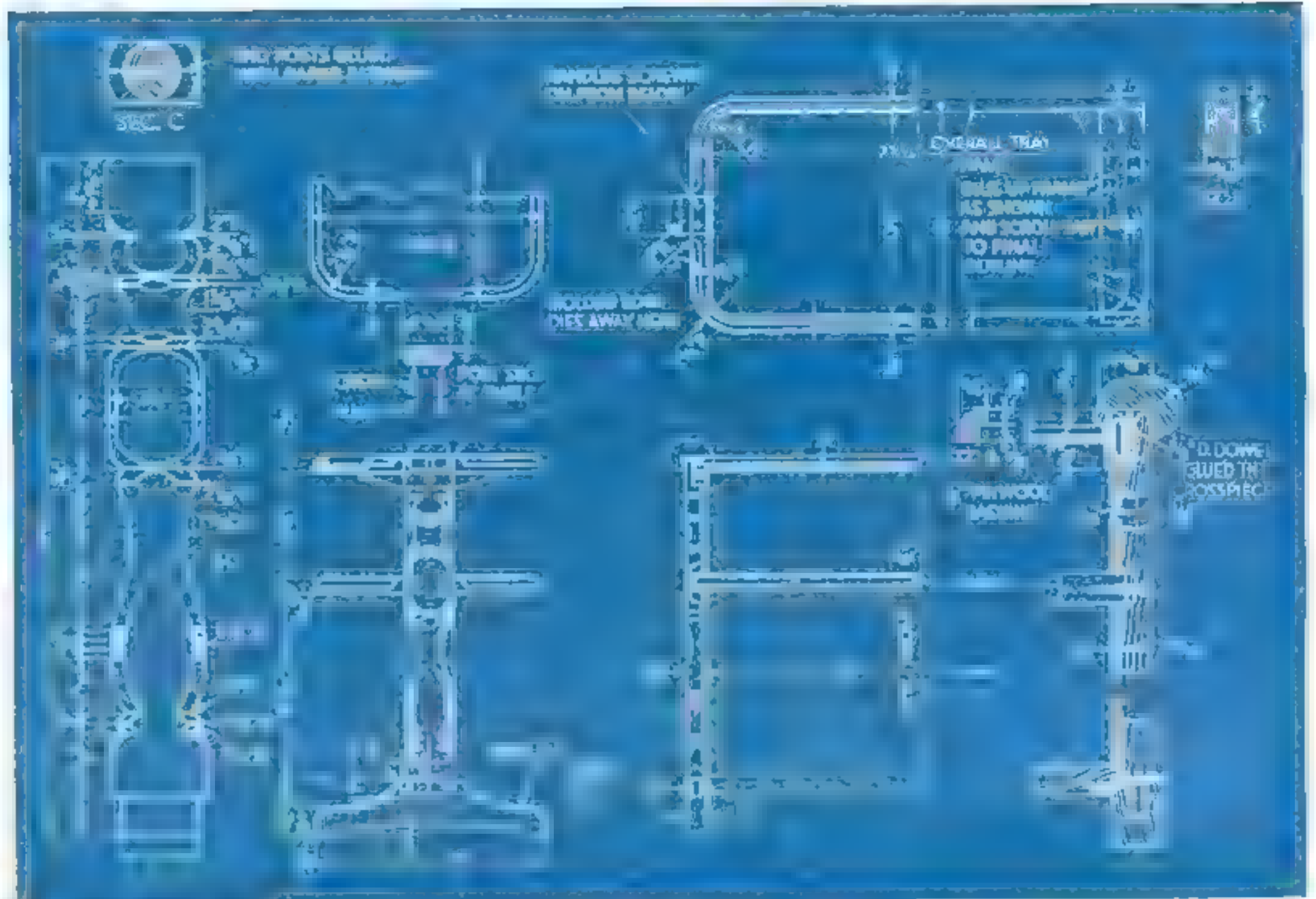


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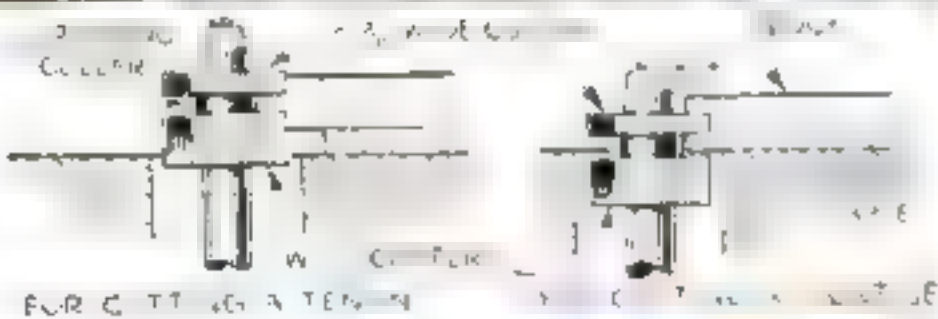
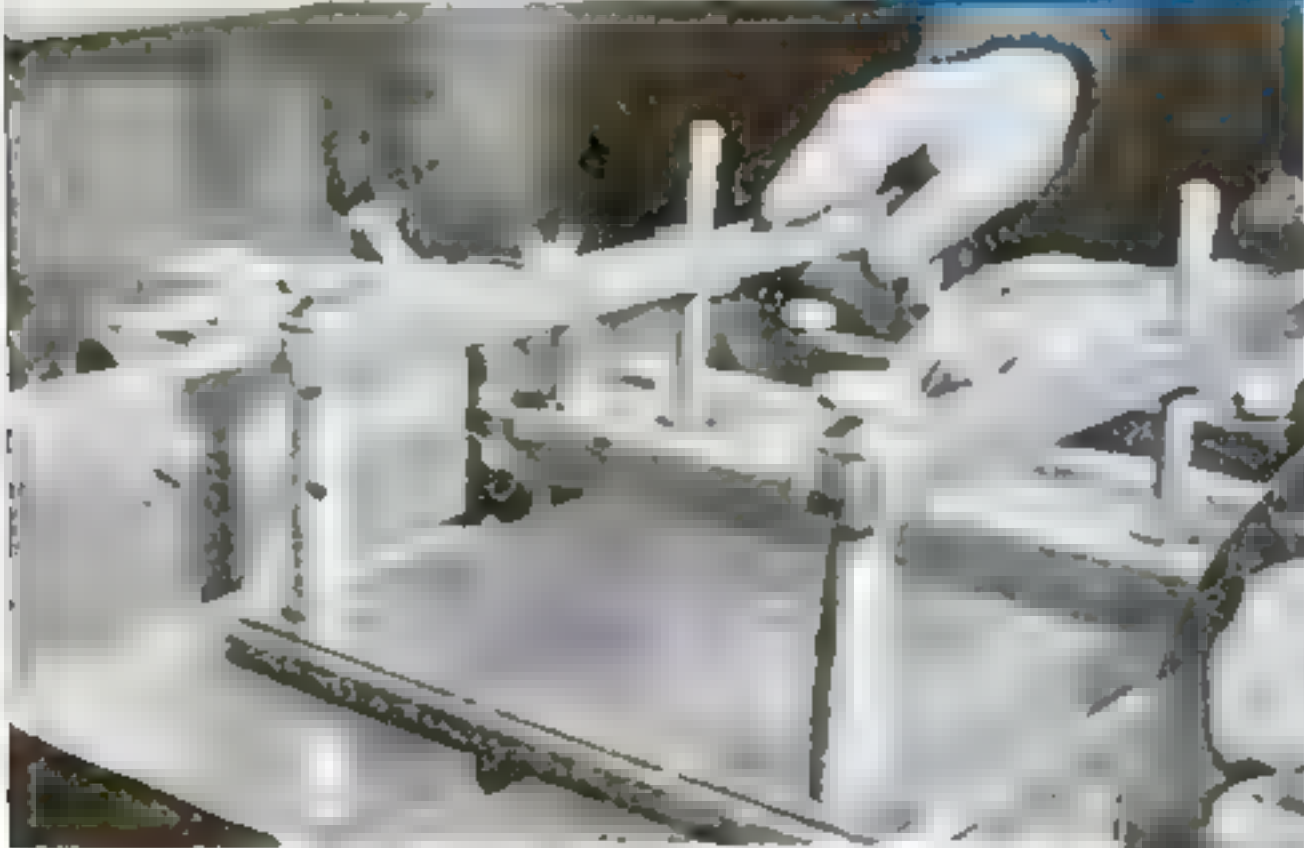
TWO TABLES and an



The tray removed from its usual place in order to show the supporting cross-pieces and dowels that retain it in position. At right, the working drawings



Unique End Table Supports Blue-Glass Serving Tray



Tenoning jig for circular saw and, above at left, cutting tenons on the shaper



ALTHOUGH at first glance it appears to be merely an end table having a special form of split turnings for the posts and with a blue-mirror top shelf, this piece of furniture has double utility because the top may be lifted off and used as a serving tray.

The model illustrated is walnut, and the second shelf is faced with figured Oriental-wood veneer. If maple is used instead of walnut, the mirror should be flesh-colored glass or even clear plate. After the tray frame is made, give the glass dealer a template for cutting the mirror to suit.

The end posts are of the same type of interrupted split turning used on the Priscilla sewing cabinet previously described (P. S. M., July '37, p. 76). The two post blanks, $13/16$ by $2\frac{1}{2}$ by $17\frac{1}{2}$ in. each, should be glued together with paper between, turned as shown, then split apart and the ends finished. The lower end, on which a $\frac{1}{2}$ by 2 by 1-in. tenon is cut, is mortised and glued in the feet. Note that the post is grooved $\frac{1}{8}$ in. deep at the level of the shelf. The shelf itself is notched $\frac{1}{4}$ in. deep and to the width of the post, and it is secured by screws with heads concealed by flush plugs. The upper ends of the posts are notched to receive the tray crosspieces and the tray itself.

The solid shelf has corners rounded to a $2\frac{1}{4}$ -in. radius, and its appearance can be enhanced by molding. The molding dies away on the ends as it approaches the joint with the shelf.

After the posts, feet, and tray crosspieces are glued and screwed to—

(Continued on page 133)

UMBRELLA STAND



Light-colored strips are fastened to the divisions to decorate the black top



The extreme simplicity of this design is what makes the stand so modern looking. There is a pie plate in the base to catch any water

Wooden Umbrella Stand Is Easy to Construct

NEAT modern lines and simplicity of construction are features of this compact umbrella stand. It holds four umbrellas, but may easily be enlarged or made smaller.

A 7-in. pie plate is used to collect whatever water drips from the umbrellas. It fits into a base made as detailed. Note that the corners are removed from the top part of the base so that air will circulate through the stand. Drive a nail through the center of the pan to hold it in place.

Although any suitable material may be used, plywood is recommended for the sides. Fasten the pieces together with simple butt joints. Strengthen the corners with $\frac{1}{2}$ -in. square sup-

ports on the inside and saw them off flush with the top.

Cut the top from a piece of 1-in. stock, preferably hardwood. The circular hole may be turned on a lathe, cut with a sweep tool in a bit brace, or sawed on a jig saw. The four dividing partitions are glued in place with dowels. Two pieces, $\frac{1}{2}$ by 1 in., are screwed to the underside for attaching the top to the sides.

The finished stand may be decorated as desired. The model illustrated was finished with a black-enameled base and top, and the sides were left in the natural wood color. Narrow strips of light-colored wood were bradded to the top partitions.—GEORGE B. HARRAN.



The stand is intended to hold four umbrellas, but it may be made larger, if desired



A Smart Softwood Coffee Table

UNLIKE most pieces of living-room furniture, this smart-looking coffee table may be made from an inexpensive softwood. Suitable dimensions are given in the drawing, but the height can be varied from 14 to 24 in. as desired.

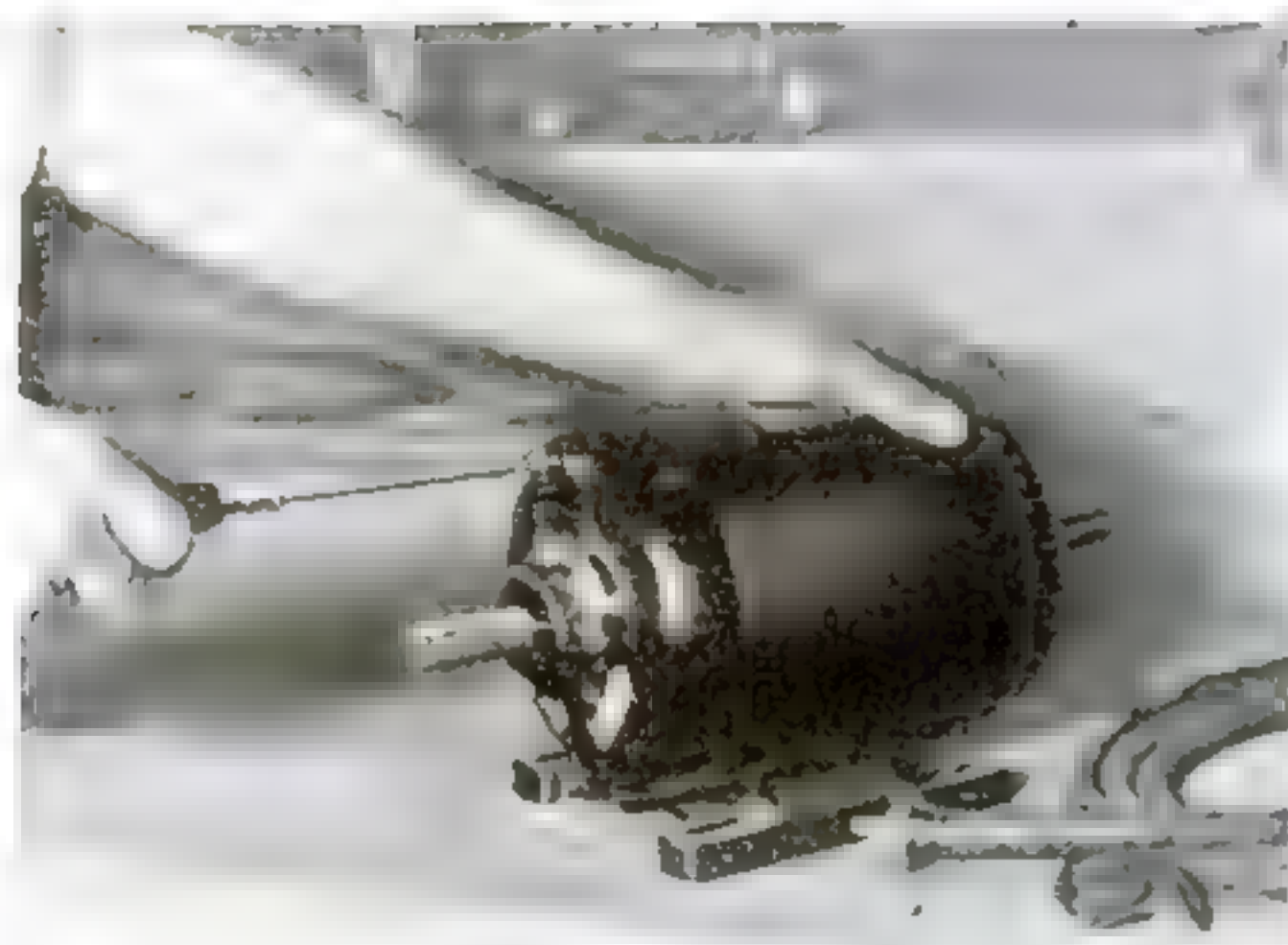


The top and bottom are sawed from glued-up stock $\frac{3}{4}$ by 24 by 24 in. This can be bought at a mill ready glued, or the work may be done by the craftsman. The kind of lumber can be whatever clear softwood the mill happens to have in stock. Douglas fir was used for the top and bottom, and redwood for the legs of the table photographed, which is the work of a college girl. The legs are made from what is known in California as "cooling-board stock;" this has an attractive V-beading over its entire surface. If such material is not obtainable, the beading may be done on a circular saw, or plain stock may be used. The edges of top and bottom can be molded on a shaper, if desired, or neatly chamfered with a plane.

The piece is assembled with $2\frac{1}{2}$ -in. No. 12 flathead screws, two at the top and two at the bottom of each leg. The small feet are then fastened on with glue and screws. The top is covered with a piece of pressed composition board, glued in place.

Walnut oil stain makes a satisfactory finish on softwood, followed by a coat of wax or varnish.—R. H. JENKINS.

Overhauling Your



After long exposure to dust in the shop, a motor must be taken apart and cleaned. Above, removing the end bells. Right, testing the brushes to see that they work smoothly



FEW shop owners seem to realize that their electric motors require periodic overhauling just as much as their automobile motor does. This is especially true if the electric motor is used on shop machinery intended for operations that give off dust or sawdust, such as woodworking machinery. The dust is bound to get in the motors, choking their operation and adding friction to the bearings. This, in turn, causes overheating and possibly a burned-out motor.

It is a good plan to make a practice of blowing out each motor once a month with compressed air or a pair of bellows. This will remove all dust and loose matter within the motor. After a time, however, an accumulation will form that mixes with the oil and grease from the bearings, and the only remedy is to take the motor apart and wash the parts with gasoline.

There are so many different types and makes of motors that it is difficult to describe each case in detail; but the instructions to follow are such as to cover motors of similar design as well. Our example is a $\frac{3}{4}$ -h.p., 3,450-r.p.m., single-phase, repulsion-induction motor that is used on a wood shaper, molder, and other high-speed machines.

Four base bolts are loosened, and the motor is taken to the bench. By the removal of two long machine screws, the bearing housings or end bells can be pried off with a screw driver.

When the motor has been opened up, we can see the hard-packed sawdust-and-grease mixture that covers the entire inside surface of the housing. There is also a good quantity around the armature and field windings. The brush-holder plate should be lifted out and examined. As shown in one of the photos, the brushes are pressed in by the thumb against the spring tension. They should work freely in their guides. Their length is compared with a new brush and if they are much shorter, it is a good plan

By
**HAROLD
P.
STRAND**

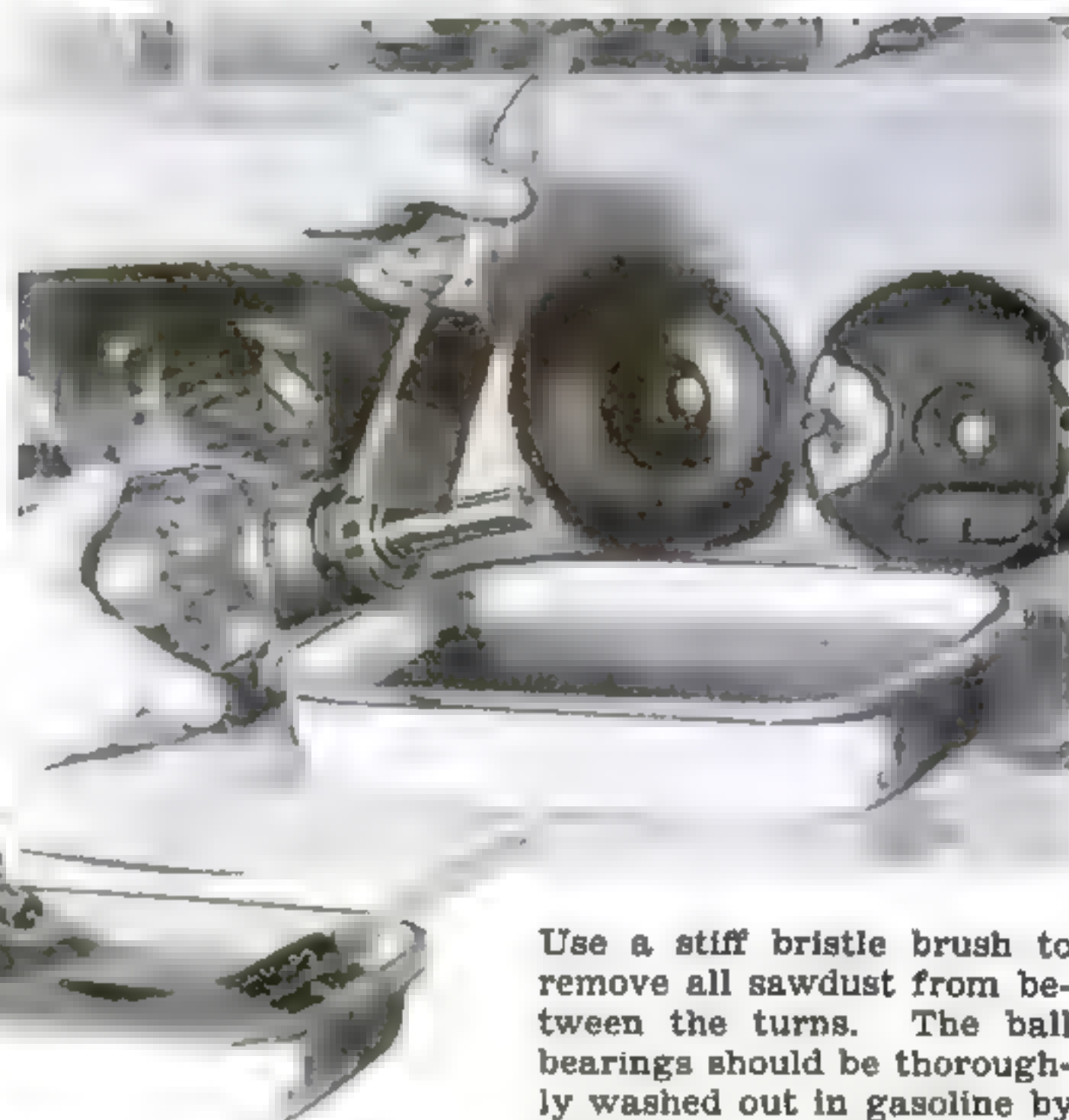
The armature is first brushed clean, then the ball bearings are washed in gasoline until they spin freely



to replace them when reassembling the motor. The plate can be washed clean with gasoline after the brushes have been removed.

A shallow pan half filled with gasoline and a clean brush may be used for thoroughly washing the bearing housings. It will be necessary to disconnect the rubber cord from the terminal box in order to get the commutator end housing free. If the motor does not happen to be equipped with ball bearings, it will probably have either waste-packed bearings or an oil ring for lubrication, with plain sleeve-type bronze bushings. In this case wash out the old oil and grit from the oil reservoirs and replace the waste with new material when assembling. If an oil ring is in use, see that it is in good shape and fits properly in the groove in the bushing where it belongs.

The armature is next given attention.



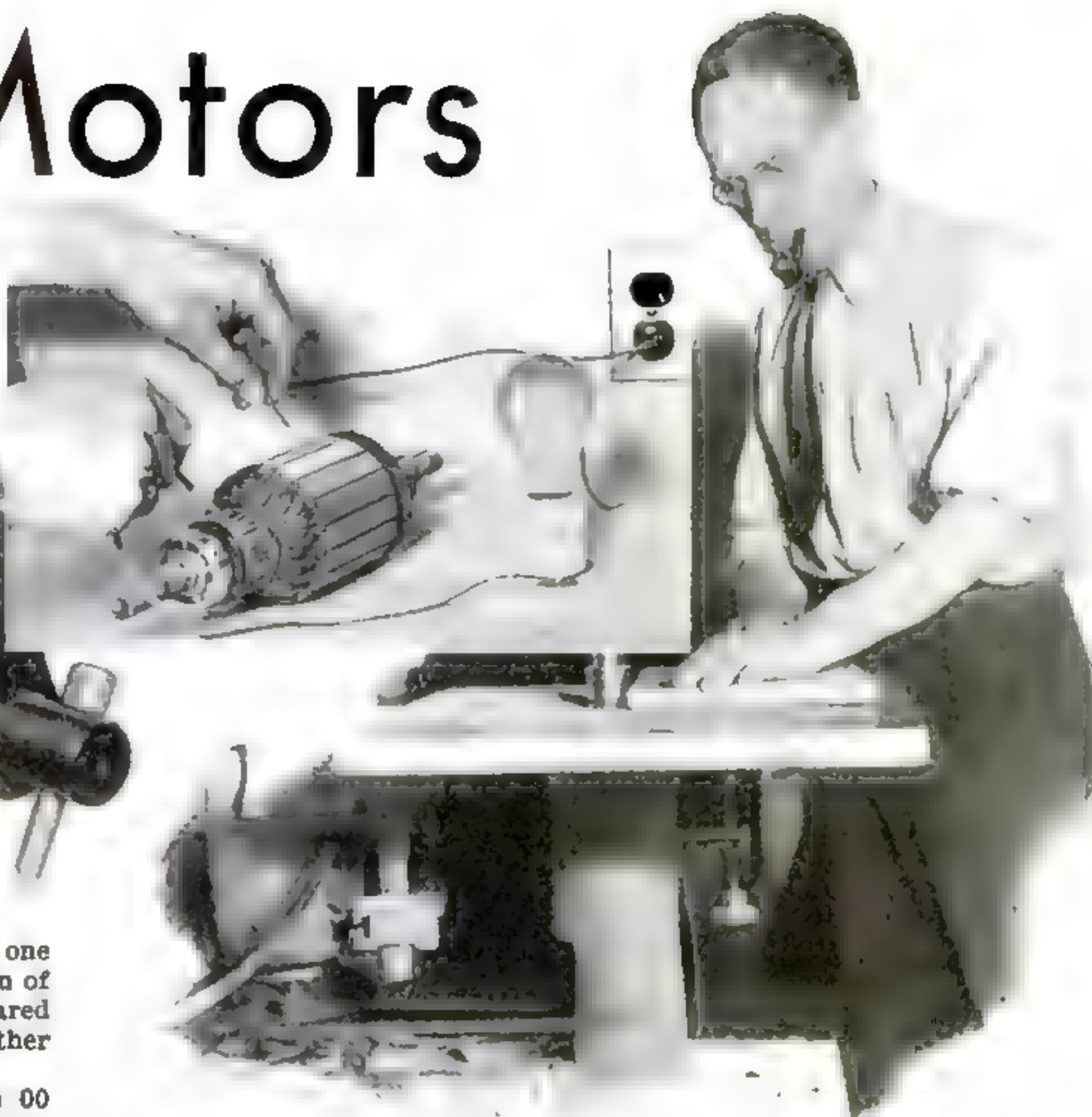
Use a stiff bristle brush to remove all sawdust from between the turns. The ball bearings should be thoroughly washed out in gasoline by holding the armature over the pan, in which some fresh gasoline has been poured. Old grease will be removed, and much grit. Washing should be continued until the bearings will spin freely with no evidence of friction or grit.

While commercial motor repair shops have many different devices for testing motor windings, the home workshop owner will have to be contented usually with making a "ground" test. A socket, three pieces of wire, and a 60-watt lamp are required, and the test is made as shown in one of the photos. One bared end of the wire is touched to the iron core, and the other is touched to the commutator. In this test no light should be obtained. If the lamp lights, it indicates that the winding is grounded or leaking to the core, and the armature should be taken to a motor shop for repair.

With the test lamp rigged up, it is

Shop Motors

A test circuit with a 60-watt lamp in series is used as at the right to make sure the armature winding is not grounded or leaking to the core. After this, the commutator must be smoothed with 00 sandpaper as shown below



well also to test the field windings by touching one wire to a spot on the motor frame that is clean of paint, and by touching the other one to the bared ends of the two field lead wires. As in the other test, the lamps should not light.

If the armature tests satisfactorily, some 00 sandpaper is cut into strips and used to clean the commutator thoroughly.

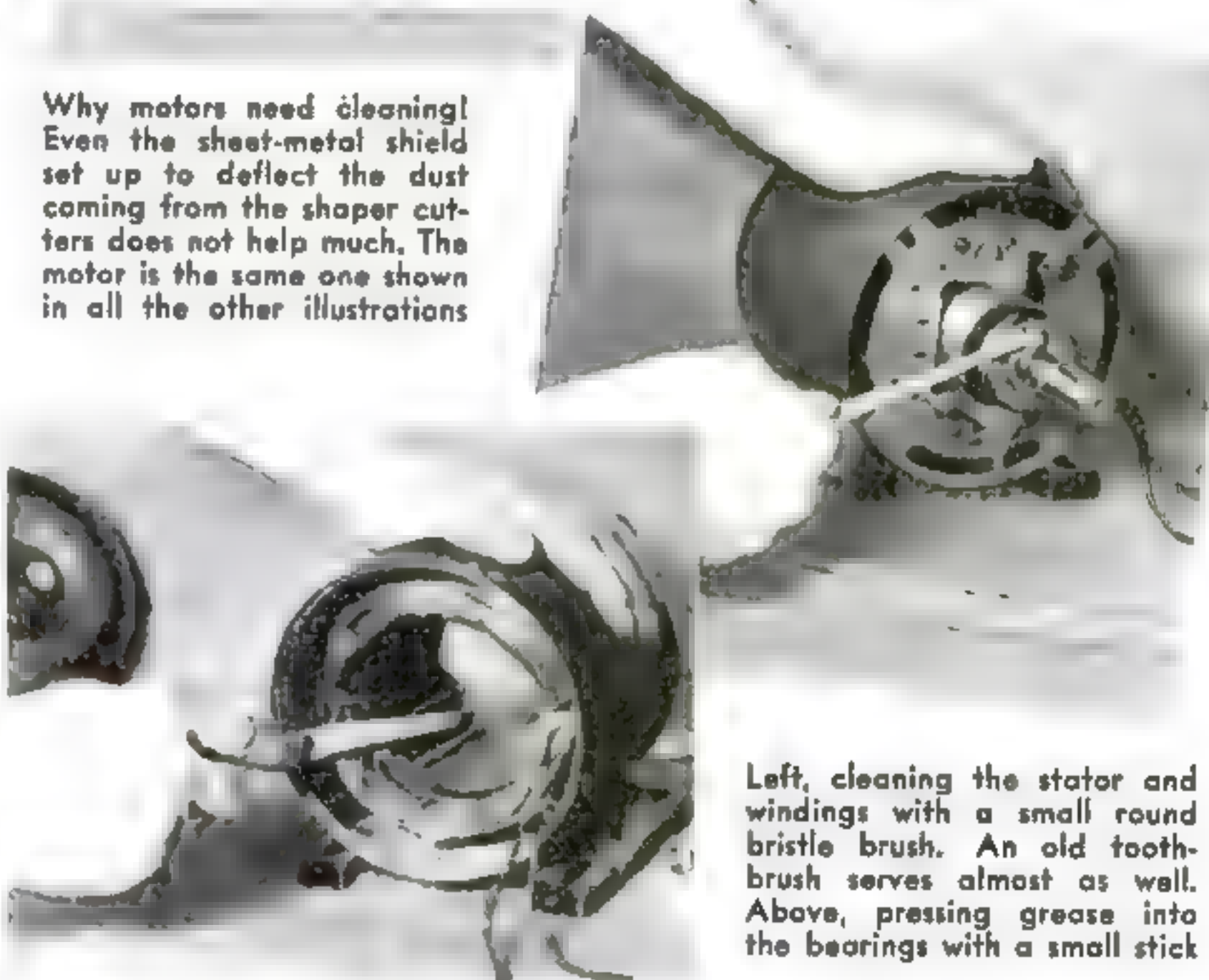
Should deep ridges or grooves be found in the copper surface of the commutator, no amount of sanding can remedy the condition. The armature is placed in a lathe, between centers, with a face-plate and lathe dog clamped to the shaft. A light cut is then taken across the commutator with a sharp turning bit. If, after examination, a groove still exists, a second cut may be necessary. Finish up with the 00 sandpaper.

The cleaning of the stator and windings is done with a small round bristle brush or an old toothbrush. Every crevice and visible turn of the windings should be carefully brushed out. Air pressure or the bellows can then be used to blow out the loosened dirt. A cloth moistened with gasoline will wipe the outside of the frame clean.

Another photo shows the motor after the armature has been replaced, and the brush holder plate is in position. Grease is applied to the bearings with a slim stick. It should be pressed well into the bearings. It is now a simple job to replace the bearing housings and clamp them together with the long machine screws.

In a following article, other types of motors and the manner in which they are overhauled will be discussed.

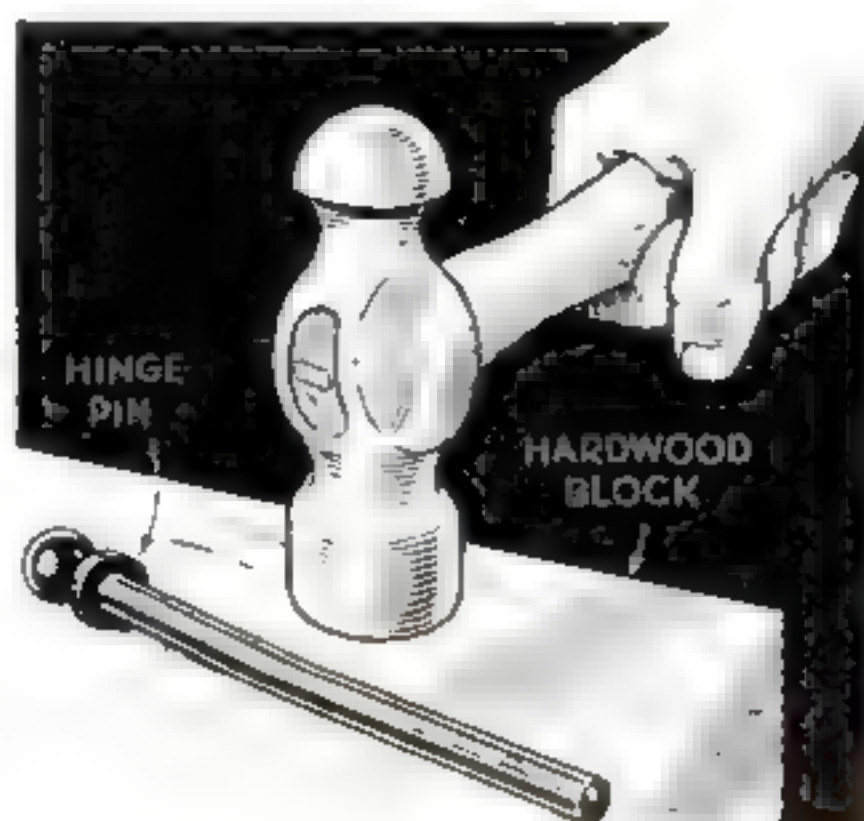
Why motors need cleaning! Even the sheet-metal shield set up to deflect the dust coming from the shaper cutters does not help much. The motor is the same one shown in all the other illustrations



Left, cleaning the stator and windings with a small round bristle brush. An old toothbrush serves almost as well. Above, pressing grease into the bearings with a small stick

Bent Hinge Pin Keeps Door from Swinging

MANY an otherwise acquired black eye or bruised nose has been accounted for by saying, "I walked into an open door." However, the fact remains that a partly open door is a hazard, particularly in the dark. Doors that persist in swinging partly shut by themselves can be made to stay open or in any intermediate position merely by removing one or both hinge pins and bending them slightly.—J. J. LUKOWITZ.



Special Sawhorse Built with V-Shaped Top

FOR certain types of woodwork, time can be saved by making a sawhorse with an open V-shaped trough for a top instead of a "two by four" or a plain plank. The two boards forming the trough should be nailed together at right angles and adequately supported by the side and end rails of the sawhorse. For sawing, drilling, or marking with a square, the trough will hold boards up to about 6 in. wide at a convenient angle without danger of shifting.

THESE ARE THE HIGHEST
HONORS A CLUB CAN WIN

- 1 An award for outstanding service in the community
- 2 For the most informative and original club programs
- 3 For the finest example of individual craftwork made by any member of the club



Announcing...

A New National Contest FOR GUILD CLUBS

TO SET up a goal of achievement for home workshop clubs similar to the academy awards made in other fields, POPULAR SCIENCE MONTHLY is sponsoring a competition for all the clubs affiliated with the National Homeworkshop Guild.

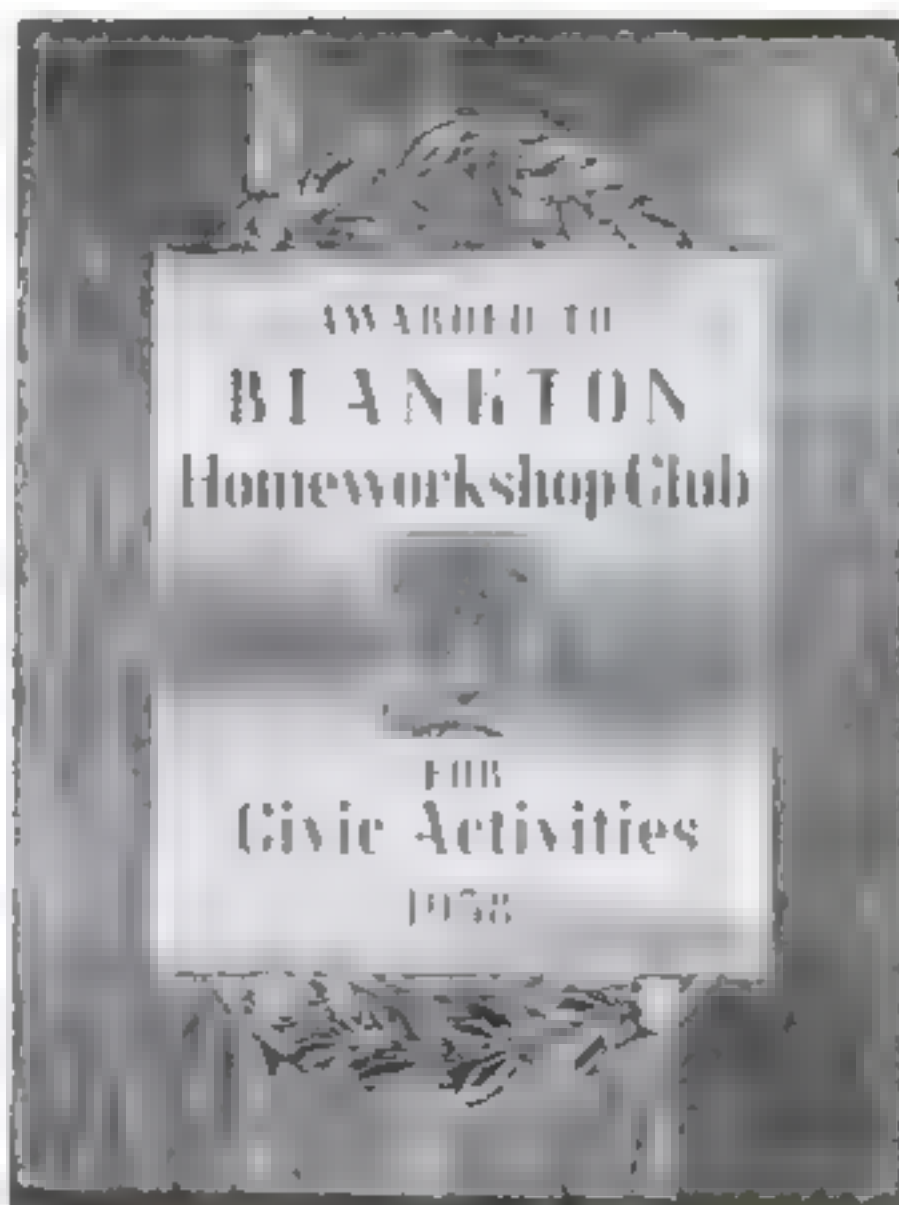
Awards will be made in three divisions, corresponding to the three most important activities of a home workshop club. The prizes will be three large, beautiful silver plaques mounted on polished hardwood. While the plaques themselves will be of the finest quality, made by one of New York's leading jewelers and engraved with the name of the club to which each award is made, there is far more involved than the mere value of the prizes. Each will represent the greatest national distinction that can be attained by a club.

One of the awards will be made to the club that accomplishes the most in the way of civic activities and community enterprises during the coming active season—that is, the six-months period between October 1, 1937, and April 1, 1938.

In the second division of the competition, an award will be made to the club that consistently presents the best home workshop programs at its regular meetings during the same period.

The third award will go to the club offering the most notable piece of craftwork made by one of its members and started on or after October 1, 1937. In this case a special sterling silver craftwork medal will be awarded to the outstanding craftsman, while the plaque will become the permanent property of the club itself.

In each classification the conditions



Design for the plaques. A fictitious name has been inserted to show clearly how each plaque will look when it has been engraved with the name of the winning club

are comparatively simple and will throw no extra burden on the clubs. All that each will have to do is to submit a complete statement of what it has done of service to its community, or of what its programs have consisted; or, in the case of craftwork, to present photographs and a brief description of the project the members believe to have been the best made during the specified six-months period. A club may enter

one, two, or all three divisions, but can receive an award only in one. In case of ties, each tying contestant will be awarded a prize equal to that tied for.

Detailed rules and regulations are contained in the monthly Guild bulletin being sent to club secretaries. All entries must be received at headquarters of the National Homeworkshop Guild, 347 Fourth Avenue, New York, on or before May 1, 1938.

By conducting this contest, issuing bulletins, job sheets, and program suggestions, and in many other ways, the Guild is actively promoting the interests of the affiliated clubs. In time, so popular has the home workshop club movement become, there will be a club in almost every community. If there is none located near you, why not start one so that you can receive the benefits of these various services (see P.S.M., Oct. '37, p. 101)? There is no expense involved in joining the Guild.

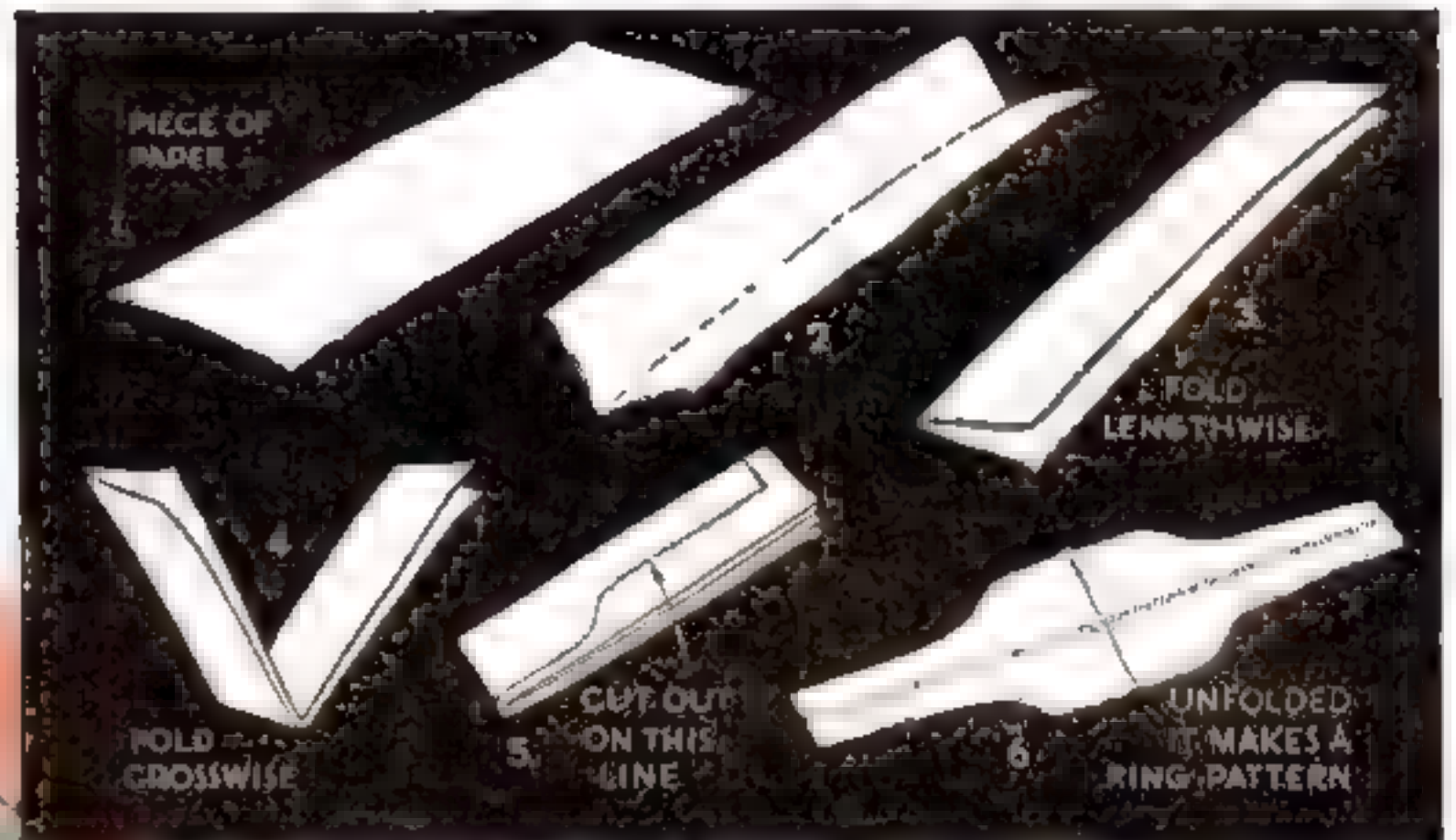
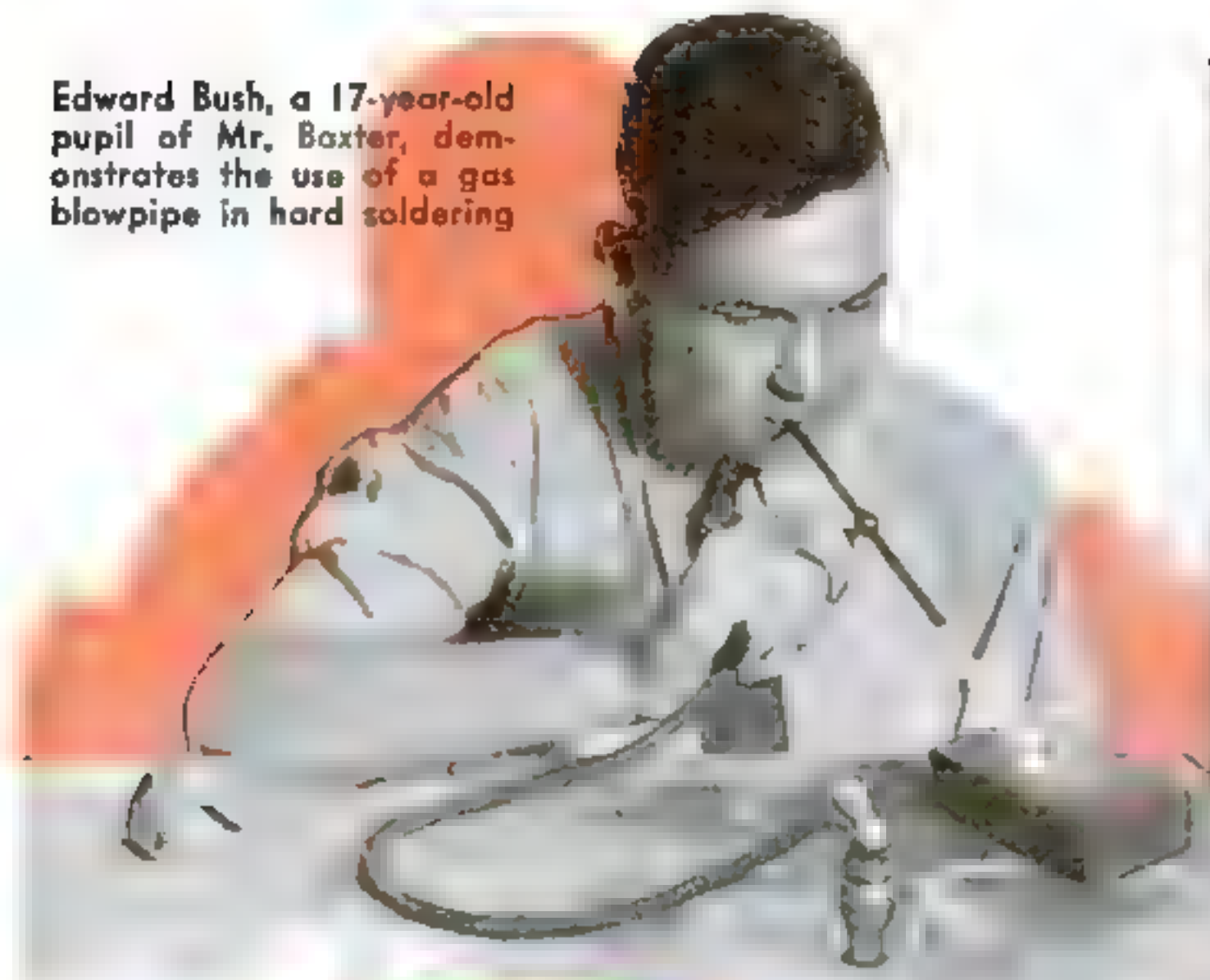
National Homeworkshop Guild
347 Fourth Avenue, New York

I don't want to miss any of the free services, contests, and other opportunities available to members of the Guild. Please send me immediately, without cost or obligation, instructions on how to organize a home workshop club in my neighborhood, and include an application blank for a free charter in the National Homeworkshop Guild. I am inclosing a large (legal size) envelope, self-addressed and bearing a three-cent stamp, for your use in sending this material.

NAME.....
ADDRESS.....
CITY..... STATE.....
(Please print very clearly)

STEPS IN MAKING Sterling

Edward Bush, a 17-year-old pupil of Mr. Baxter, demonstrates the use of a gas blowpipe in hard soldering



Work begins with a paper pattern—in this case, for a ring to be made by the method shown below. Trim the ends until the pattern fits the finger



The paper pattern is pasted on 18- or 20-gauge sterling silver, and the blank is cut out with a jeweler's saw over a V-notch in a bench block

MANY beautiful rings and other pieces of jewelry may be made at home by the methods illustrated. Few tools are required, and the sterling silver and other materials are not expensive in comparison to the value of the finished articles, judging by the prices asked for handmade jewelry.

A good assortment of tools, in the order shown below, consists of a small ball-peen hammer, jeweler's saw, hand grinding and buffing tool, blowpipe, tweezers, half-round file, pointed pliers, burnisher, flat file, plate shears, and ring mandrel.

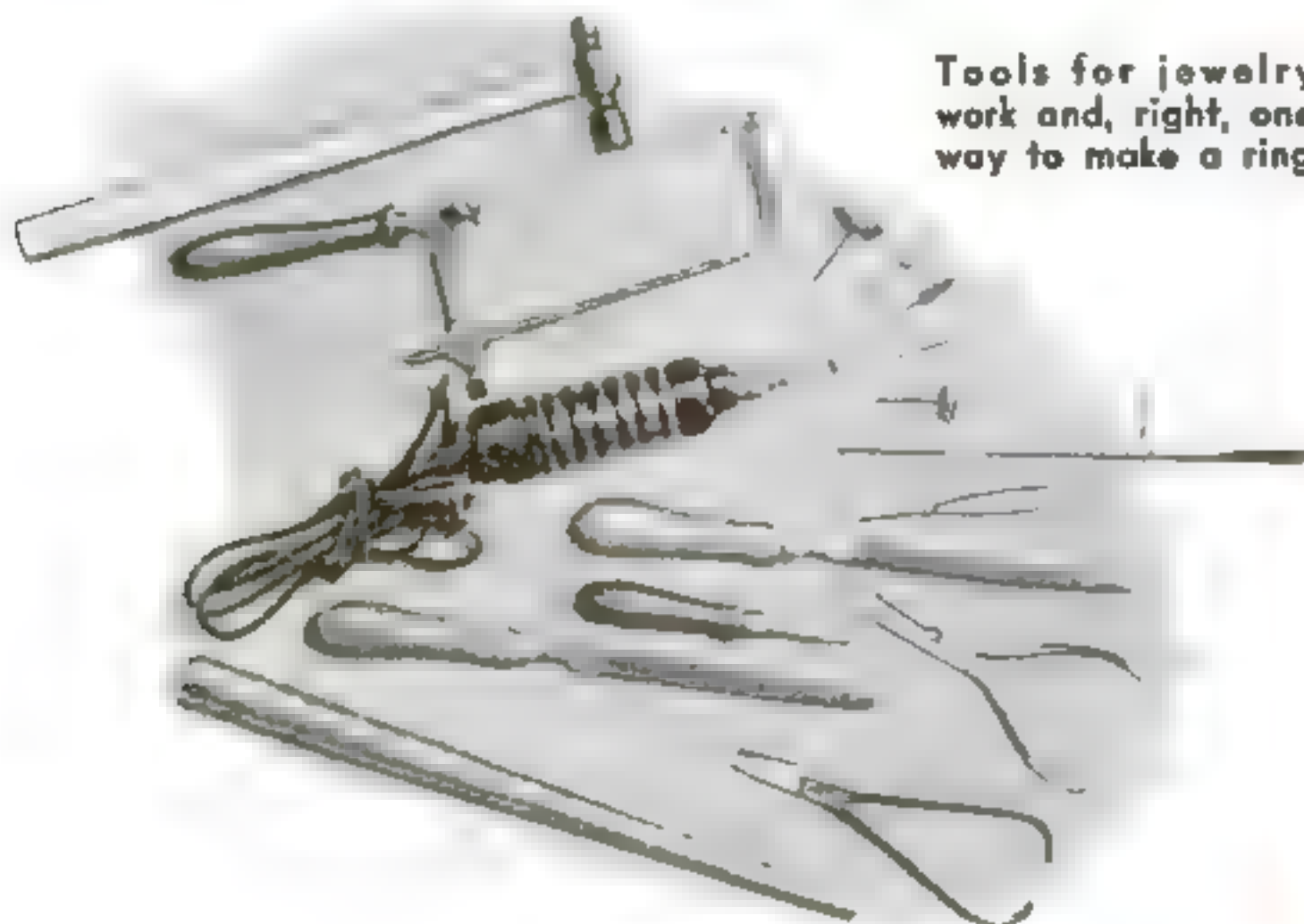
Prepare the pieces necessary for the type of ring you wish to make, as suggested in the sketches, and silver solder them together. Do the soldering on a charcoal block or a piece of asbestos. For heat, use an alcohol torch or a gas blowpipe. The blowpipe shown in use above merely requires to be attached with rubber tubing to a gas outlet at the kitchen stove or wherever such a connection is available. Turn on the gas, light it at the end of the blowpipe, and blow through the pipe.

In silver soldering, use small pieces of solder and a paste of borax and water for the flux. Apply heat gently until the water has evaporated. The solder will melt and flow when the silver reaches the red-hot stage.

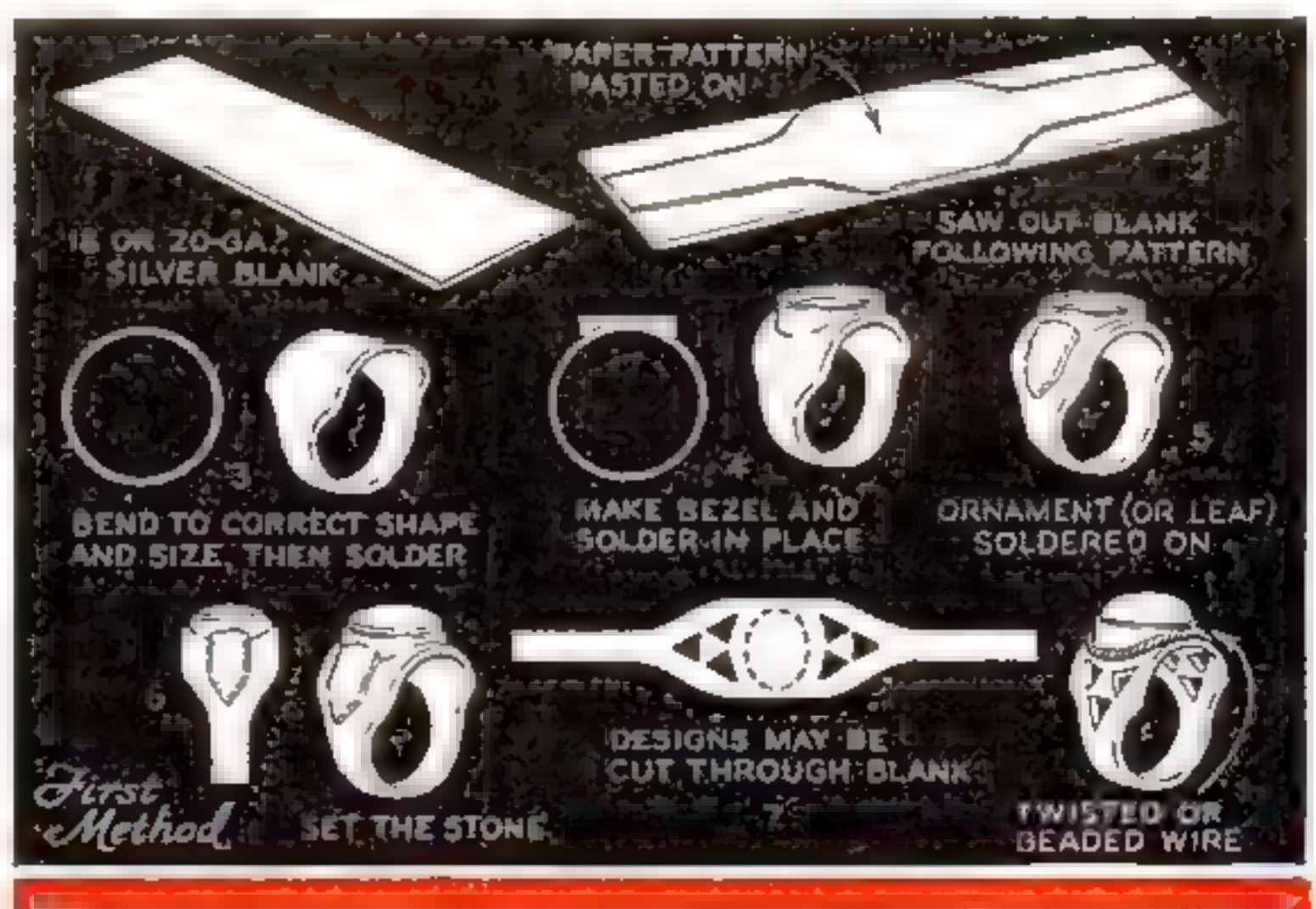
After soldering, clean off the borax and oxide by dropping the article, while hot, into a weak pickling solution of sulphuric acid and water. Keep iron wire and tweezers out of the solution,



This is the type of gas blowpipe used. It gives an easily controlled, very hot flame



Tools for jewelry work and, right, one way to make a ring



Silver Jewelry

IT'S MUCH EASIER THAN
YOU THINK TO FASHION
BEAUTIFUL GIFT PIECES

By W. T. BAXTER

Art Metal and Jewelry Instructor,
Woodrow Wilson High School, Washington, D. C.



Design for bracelet with a twisted wire around the bezel and etched ornamentation over the surface



Jewelry making is a good hobby for those who have no room for a regular home workshop and cannot build furniture or other large projects. It encourages originality, for no two designs need be alike

as iron will cause silver to turn black.

Polish the completed piece by using jeweler's rouge on a felt or muslin buff.

In etching designs, such as the one on the bracelet, clean the silver by pickling, cover the back and edges with a coat of thin asphaltum varnish, and use a small artist's brush to paint in the border and design on the front. When dry, place the piece in a glass or porcelain vessel and cover with the etching solution, which is dilute nitric acid. If too weak, add more acid, and if the solution works too fast, add more water. When the design has been etched deep enough, remove the article, wash it, and remove the asphaltum by rubbing with a cloth moistened with turpentine.

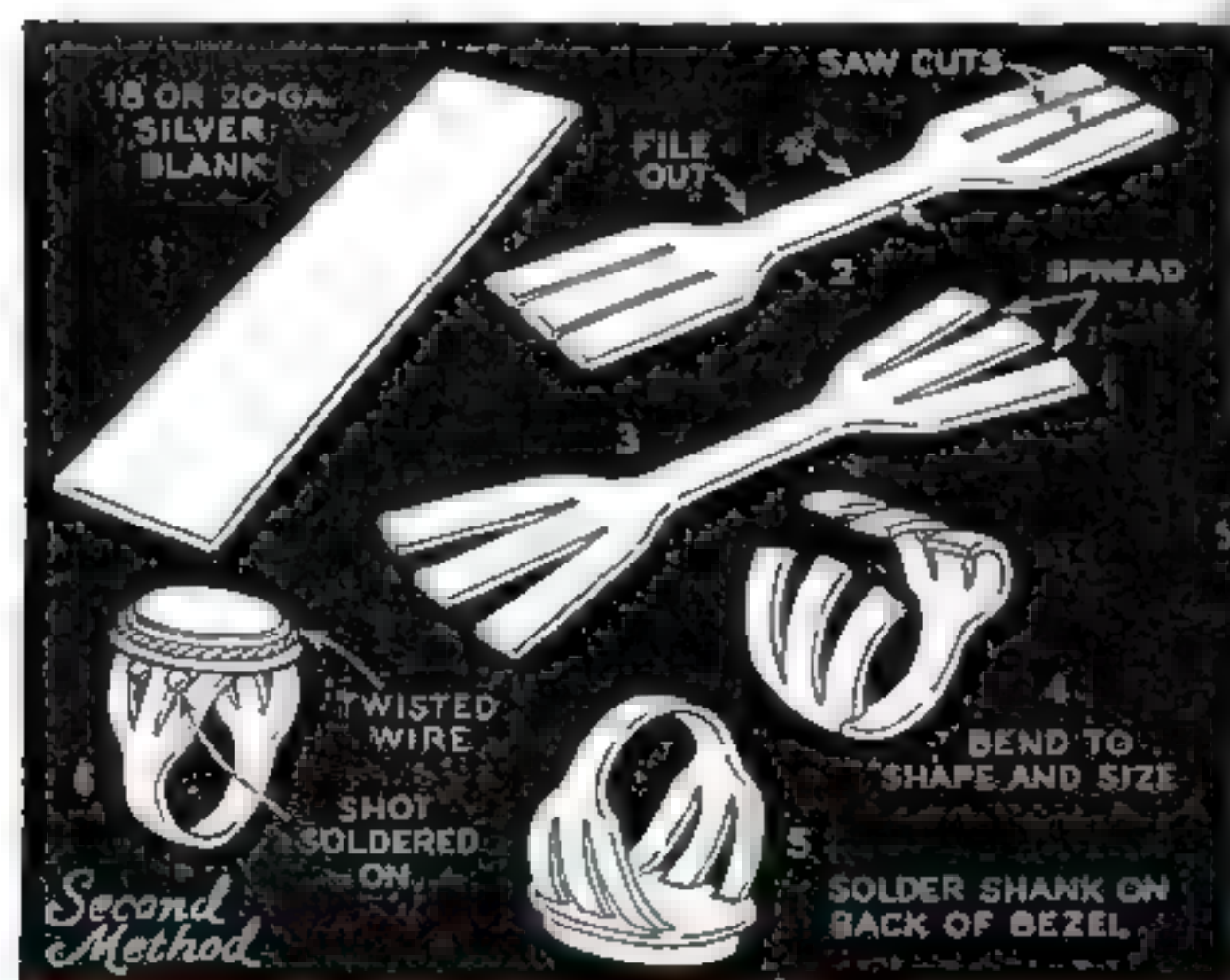
The bracelet may now be bent to shape, the bezel soldered in place, and the stone set by gently turning in the top of the bezel against the stone with a burnisher or a nail set, the end of which has been rounded and polished.

For additional information on jewelry making, see *P.S.M.*, Oct. '36, p. 76; and for methods of cutting and polishing gems, refer to *P.S.M.*, Dec. '36, p. 63.

For buffing rings and other small pieces, a high-speed hand grinder like that shown below is very useful



Seven rings and a pin made by beginners—clear proof that the work is easily learned



Left, the second method. Above, enlarged cross section of a bezel. Right, bezel filled with yellow ochre to protect it while soldering on an ornament





Dummy Swordsman

PROVIDES FAST FENCING PRACTICE

By LAWRENCE KRANIS

SWASHBUCKLING cavaliers, in the days when the Three Musketeers matched their blades against their many enemies, learned swordsmanship by persistent practice in a hard school. We can brush up on our fencing skill a lot more easily by the simple expedient of using a mechanical instructor like that illustrated.

"Joe," as we call our tireless fencing master, has many tricks up his sleeve, and when he gets warmed up, he's a pretty tricky opponent. One has to step lively to match him. Fencing with the dummy brings a large number of muscles into play and calls for a variety of movements, thus making it a quick, responsive exercise, calling for a steady eye and alert action.

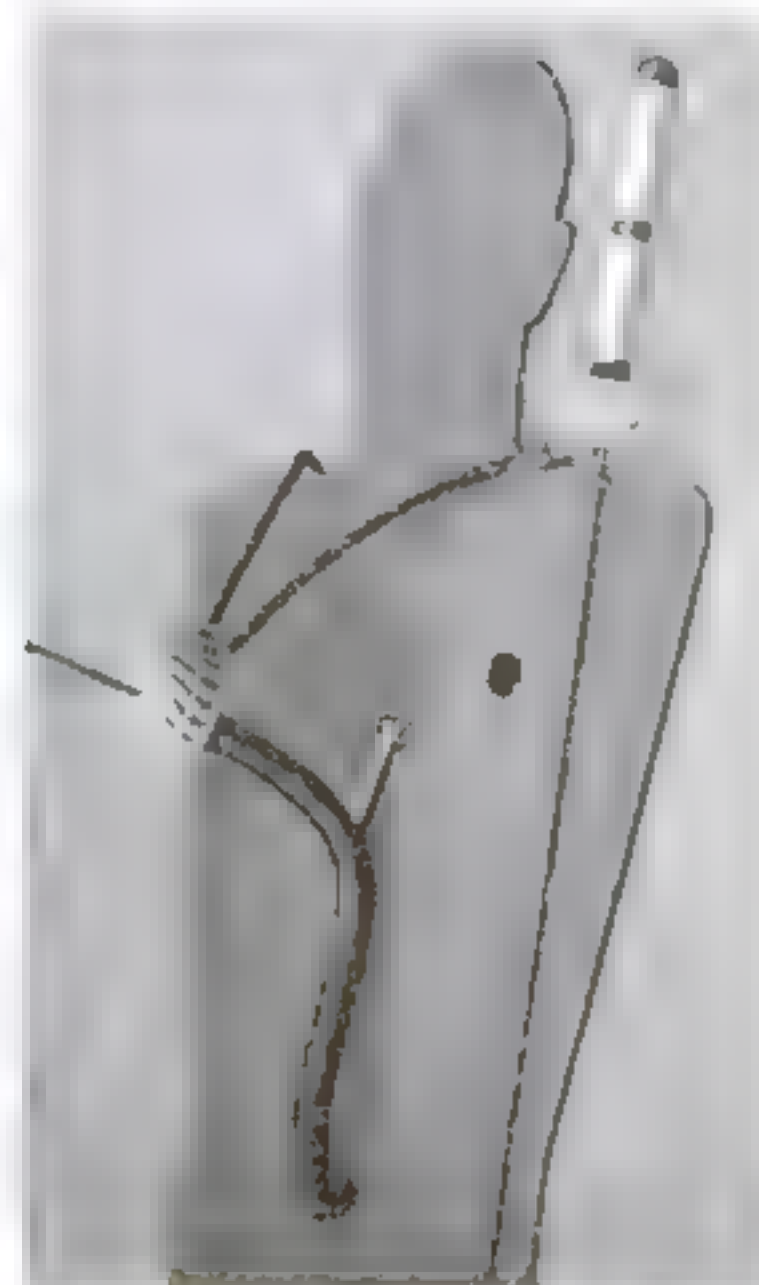
To build the instructor, first cut the figure from $\frac{1}{4}$ -in. plywood after making a full-size pattern on heavy paper. The rounded parts are cut with a scroll saw, and the long straight parts with a regular handsaw.

Next cut a piece of $\frac{3}{4}$ -in. wood the shape of the shoulders and 8 in. wide. Screw this piece to the figure as shown. The side of the figure this is on is to be the back. Cut another $\frac{3}{4}$ -in. board 8 by $11\frac{1}{2}$ in., and screw across the back at the bottom. Measure 28 in. down from the top, and in the center of the back screw a $\frac{3}{4}$ -in. thick piece, 3 in. square.

Hinge the figure to a baseboard $\frac{3}{4}$ by 12 by 33 in., and arrange the three strap hinges so the bottom edge of the figure is held $\frac{3}{4}$ in. above the base in the manner illustrated. Fasten four ball-bearing caster wheels under the base.

The two feet for the figure are cut

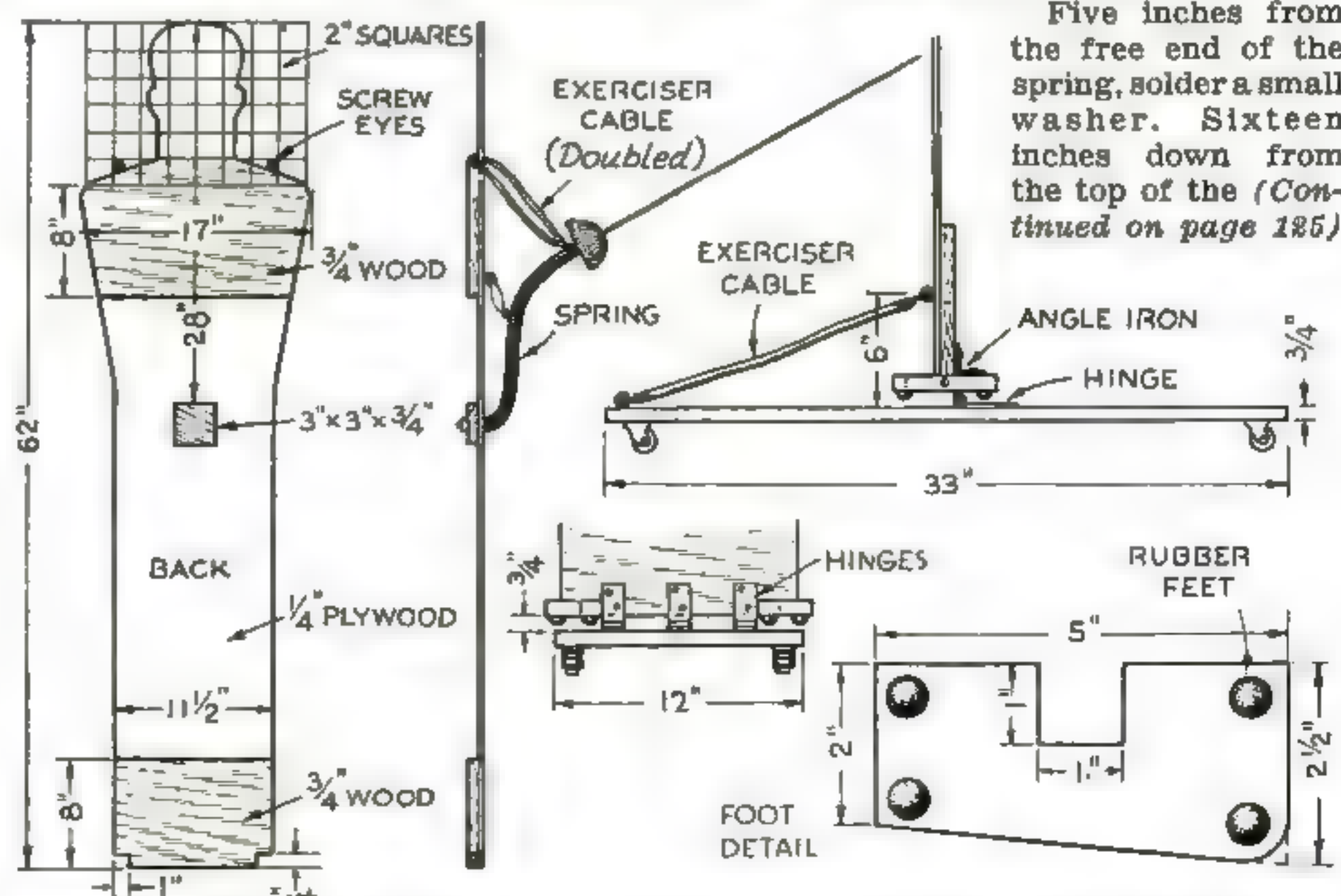
from $\frac{3}{4}$ -in. stock. On each of the four lower corners of each foot, screw a small chair-leg rubber. In the center of each foot cut an opening 1 in. square. Notch the lower corners of the figure to form a half-lap joint with the feet. Then fit the feet on the figure, one foot on each side, in such a way as to allow the dummy to rock back and forth easily and provide a springy action. Screw the feet in place and for additional bracing, use a small



The robot fencing master's foil is set in a coil spring and supported by rubber exerciser cables

bought very cheaply. In one end of the spring insert a 2-in. long bolt. This can be done by bending the spring and opening it sufficiently to allow the insertion of the bolt. The bolt passes through a hole drilled through the figure in the center of the 3-in. square block. Lock it with a nut and lock washer.

Five inches from the free end of the spring, solder a small washer. Sixteen inches down from the top of the (Continued on page 125)



Back and side views of the figure, the way it is mounted on the base, and one of the feet

MODEL OF THE SEAGULL

... Fast Scout Observation Plane Used by the U. S. Navy

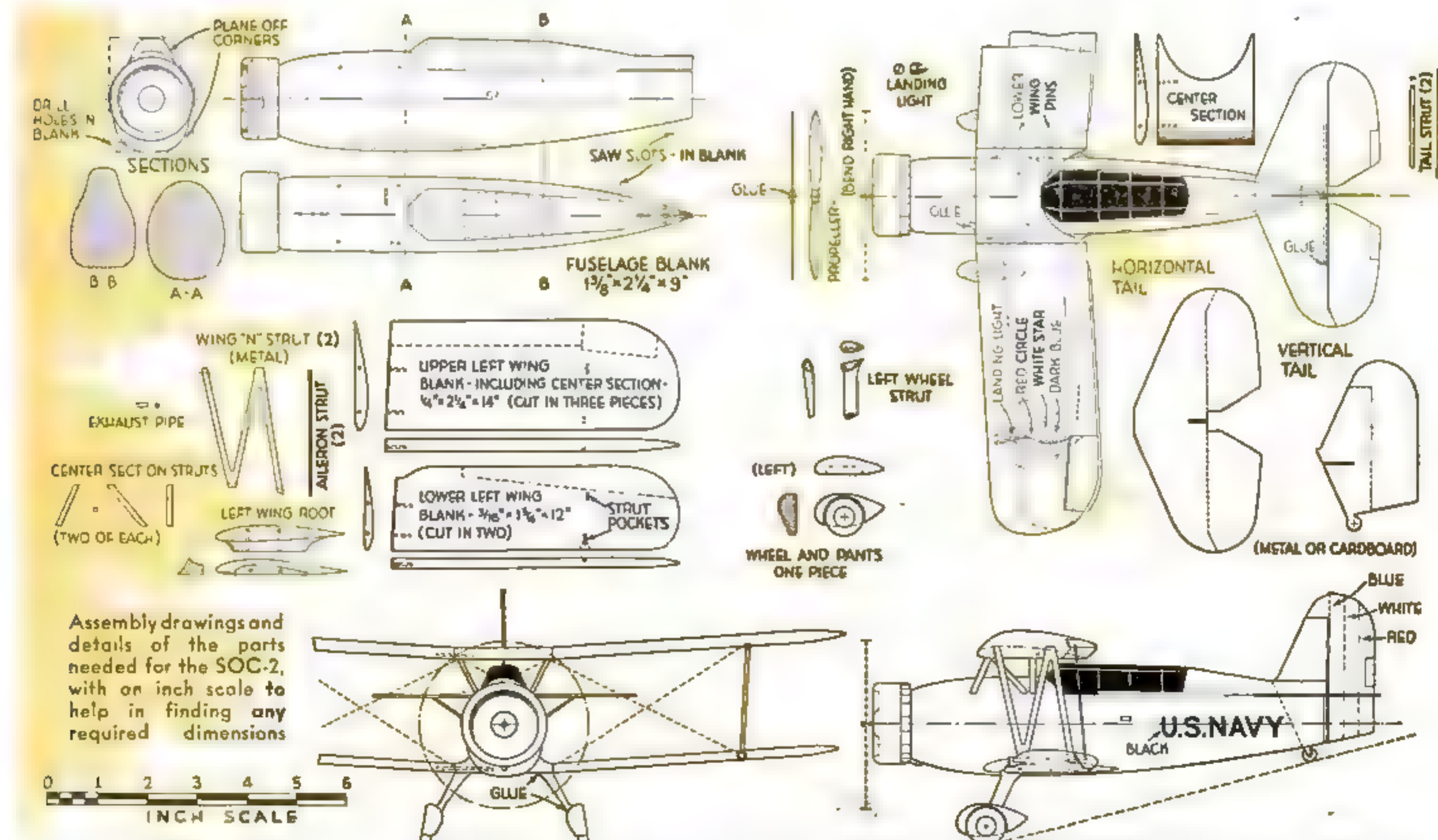
By DONALD W. CLARK

TWO fast and famous Navy planes that serve as the "eyes of the fleet" are the Curtiss Seagull SOC-1 and SOC-2. They are scout observation biplanes, identical except that one type has regular landing gear and the other is a seaplane.

The scale is our usual one of $\frac{1}{8}$ in. to the foot. When making the lower wing roots, leave the inner sides until the last, then slip them on the wing pins and carve away the wood until they fit snugly against the fuselage. Work from the bottom up in assembling the wings. Attach the lower wings, then the N-struts. Fasten the upper wings to the center section, and glue this unit to the top of the N-struts. Next put in the rear center struts, the front ones, and the diagonal struts last. Cut pockets for the ends of the struts.

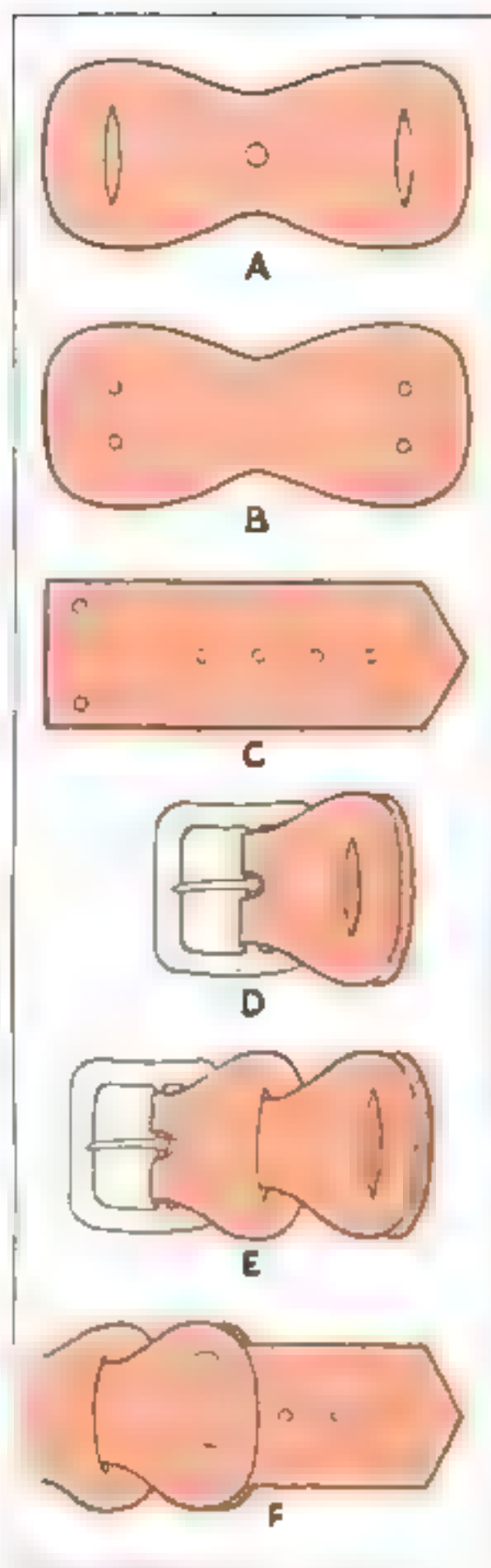
Paint the entire plane light (Navy) gray and yellow on the top surface of the upper wing. The tires, windows, and other details are black. The usual red, white, and blue wing insignia should be placed on top of the upper wing as shown and on the underside of the lower wings at the same distance from the ends as on the upper wing. U. S. NAVY should be lettered in black on both sides of the fuselage near the tail. Three stripes, blue, white, and red, with the blue nearest the hinge, may be painted on the tail, or a single color may be used. Many Navy planes have the entire tail painted a particular squadron color, as a solidly colored tail is easier to recognize.

The seaplane model (SOC-1) is made by adding a pontoon and wing floats





Red and gray rubber from old inner tubes form the body of this sport belt. The pieces are cut out and assembled as at the right



SMALL, EASILY MADE Novelties

IN WOOD, METAL, GLASS,
LEATHER, AND RUBBER

Sport Belt from Inner Tube

GOOD-LOOKING sport belts for boys or girls are easily made from old rubber tubes or discarded felt hats. All you need to make a rubber one are a red and a gray inner tube, a small belt buckle of the type with a tongue, and two so-called "bachelor's buttons," which are made like cuff links and can be snapped on without sewing. Four ordinary buttons sewed together like cuff links could be used instead, but the others are better.

With a pair of sharp scissors, cut seven pieces exactly like pattern A from the red tube, and seven more from the gray one. The first gray piece should have

a small hole cut in the middle for the tongue of the buckle. In the seventh one, instead of the long slits in the ends, there are four holes for the buttons as at B. Now cut a straight piece C from the gray tube, $1\frac{1}{2}$ by 5 in., and make the holes as indicated.

Take the first gray piece with the center hole and double it back on itself, wrong side out. Slip the hole over the tongue of the buckle as at D. Now slip a red piece through the two slits of the gray one. Double it back on itself as at E, and continue, alternating the colors. Always turn the wrong side of the rubber out. Place the square end of C between the ends of the last red piece and snap the "bachelor's buttons" through the two sets of holes as at F.

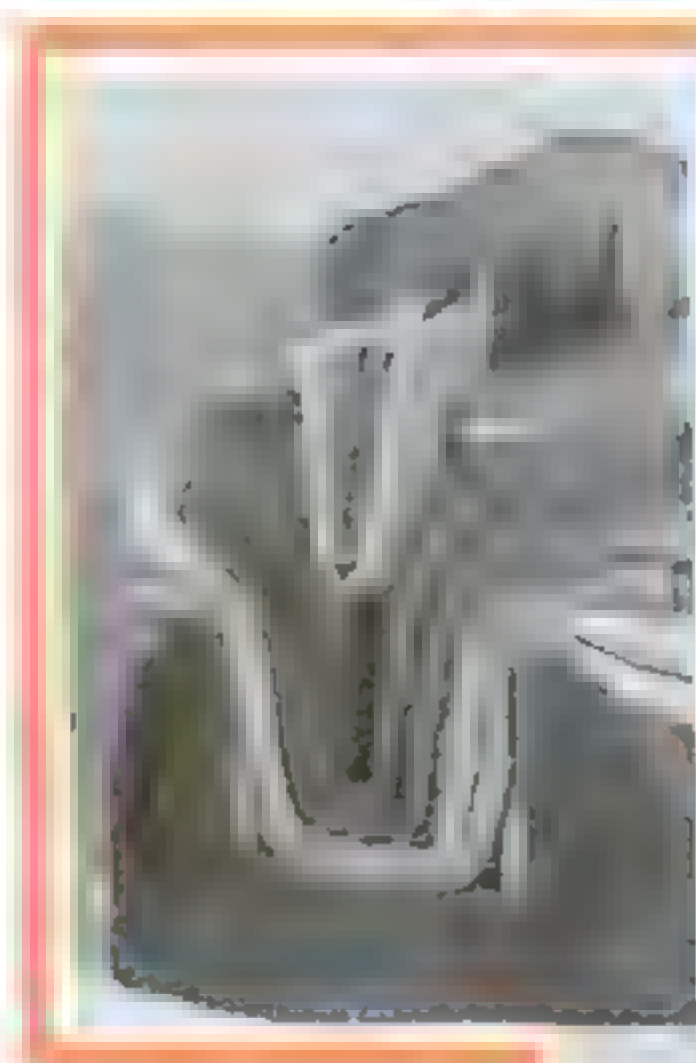
To shorten or lengthen the belt, use fewer or more pieces.—MARIAN M. BLISS.

A Snapless Leather Key Holder

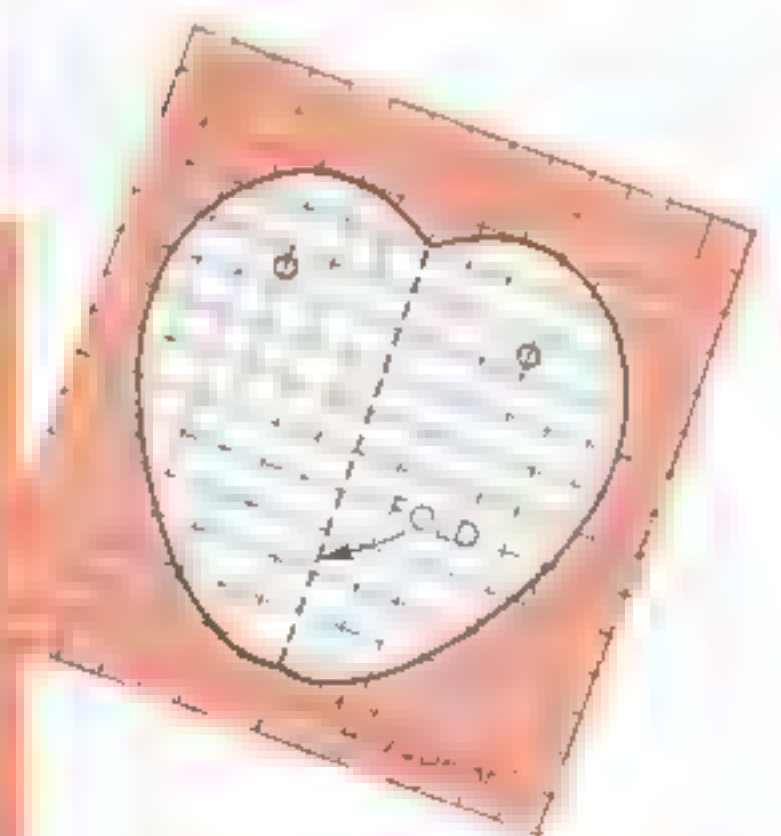
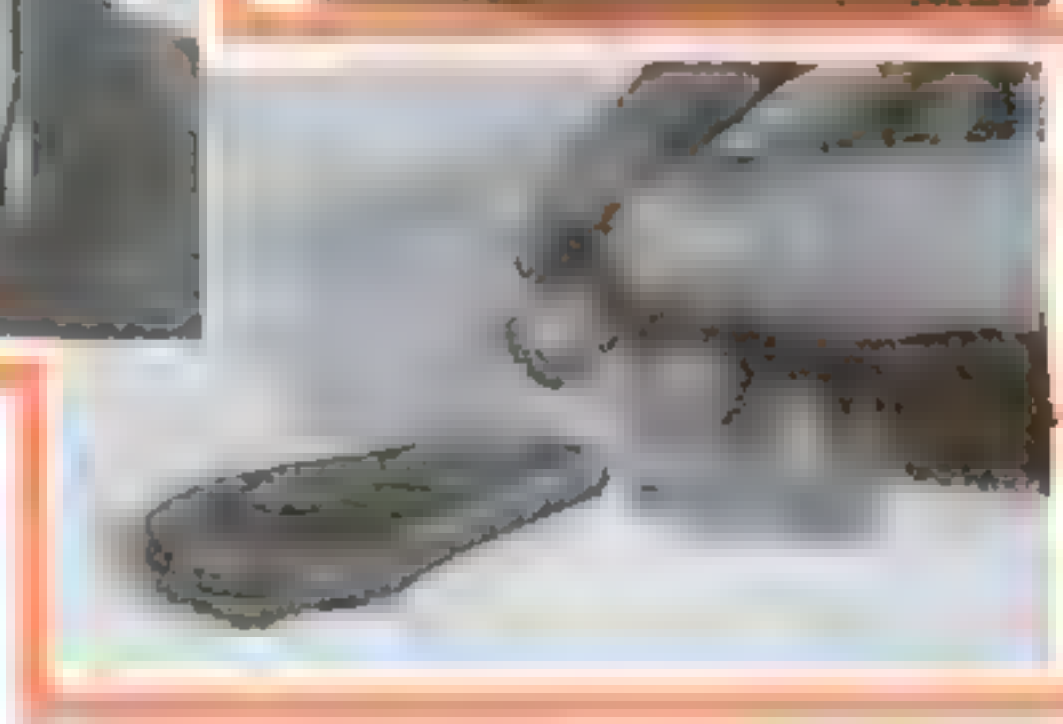
BY A SIMPLE method of molding leather to the desired shape, a pocket key container may be made without the use of a snap or other fastening to keep it closed. This simplifies the construction and adds to the durability, since it is usually the fastener that wears out first.

A piece of tooling steer (or two pieces of tooling calf, fastened together with waterproof glue or cement) is cut and punched approximately as in the diagram at the extreme right. The leather must now be tempered by soaking it for half an hour, draining, rolling in oiled paper, and mellowing from twelve to twenty-four hours. It is then folded, the keys and the screw post (purchased from a dealer in leather craft supplies) are inserted, and the whole is placed in a fold of clean blotting paper and pressed between folded cloths in a vise or press for an hour.

The piece is finally trimmed and tooled. Stain the edges to suit, place the holder in a cool, shaded spot until dry, and complete by waxing.



After the leather has been molded in the vise, it may be tooled in any desired design

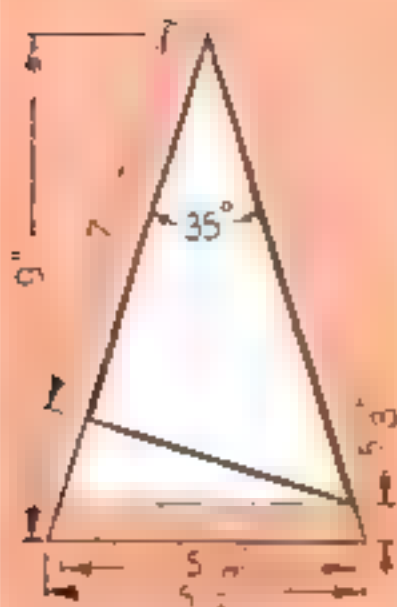


Pattern for cutting the leather

Wave-Crest Mount for a Model Flying Boat

ANY flying-boat model can be displayed to better advantage by setting it on a wave-crest mount of the type illustrated. The base is $\frac{3}{8}$ in. thick and 5 in. in diameter. The "wave" is cut from a piece of $\frac{5}{8}$ - or $\frac{3}{4}$ -in. wood, 2 by 5 in. A 1-in. length of wire about $\frac{1}{16}$ in. in diameter is set into the top to hold the model in position. Paint all blue except the bottom edge.—D. W. C.





Conical Book Stop Turned from a Block of Wood

OF STRIKING modern design, this easily made book stop is nothing more than a turned wooden cone with the base cut at an angle. It is made from a $5\frac{1}{2}$ by $5\frac{1}{2}$ by 9 in. block, which is screwed to a faceplate. The other end is supported with the dead center only during the roughing-out process.

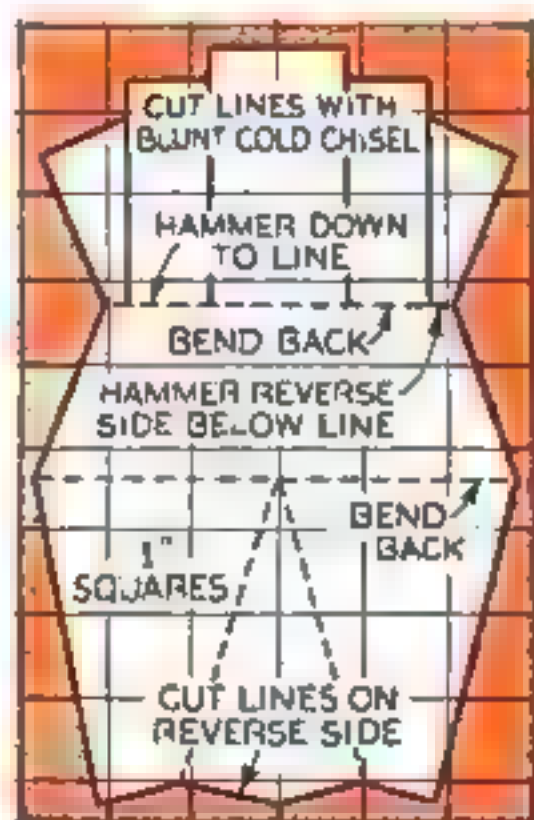
When the cone has been turned, sanded, and finished by "burning in"

shellac, it is removed from the lathe, and the base is cut as shown in the diagram. A 1-in. hole is then bored $1\frac{1}{2}$ in. deep into the base and centered $1\frac{1}{4}$ in. back from the 90-deg. angle. This hole is filled with lead or solder to add weight. The piece is completed by gluing felt, sheet rubber, or cork gasket material to the base and trimming it carefully around the edges.—J. W.

Hammered Copper Letter Holders

STATIONERY holders are easily made as shown from 18-gauge soft sheet copper.

For the modernistic design, cut the metal as indicated in the drawing. Hammer the front surface as far as the dotted line, then turn the piece over and hammer the remainder from the reverse side. The lines are cut with a small, blunt cold chisel. Bend to shape in the vise so that the lines on the upper section will come on (*Continued on page 129*)



Silver is scraped from the center of the mirror so the clock face is seen



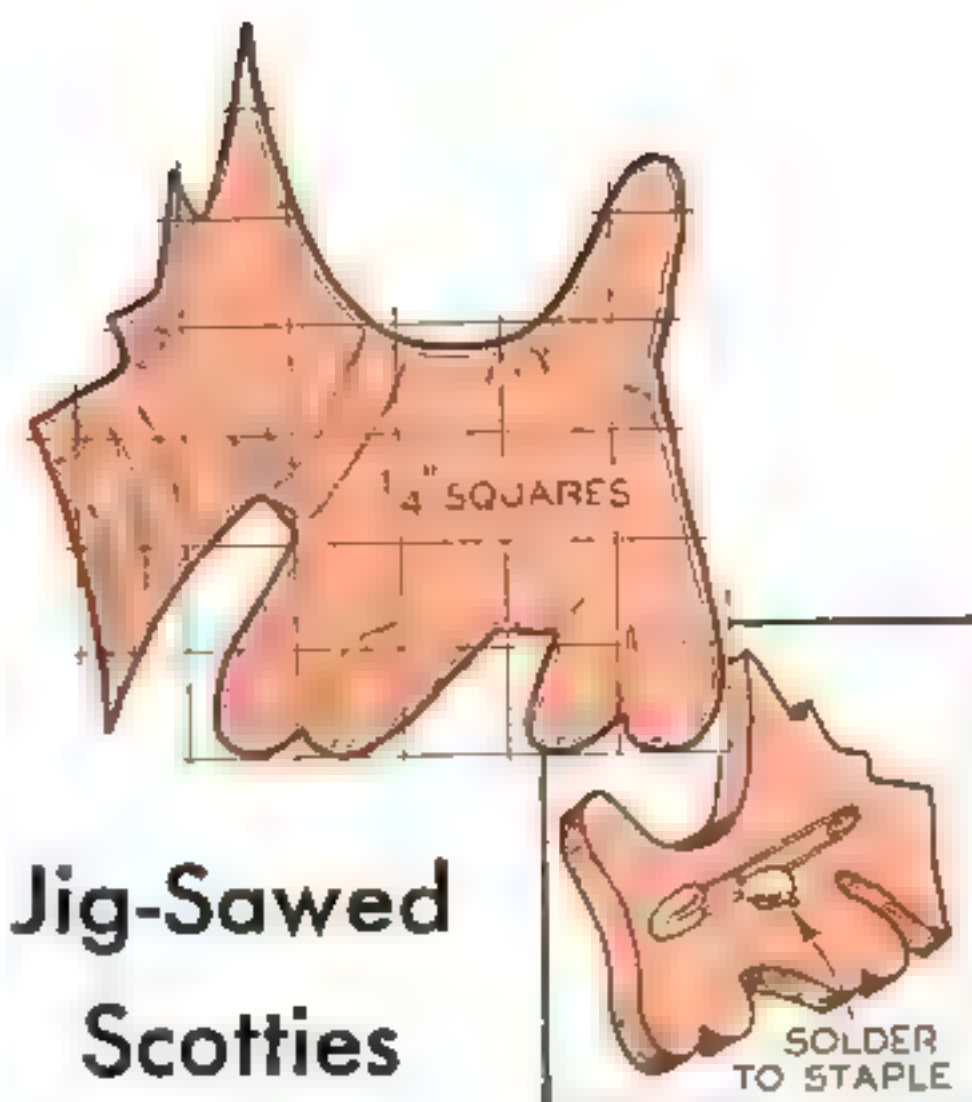
Mirror Modernizes an Old Alarm Clock

REGARDLESS of its age or the number of dents in its case, an alarm clock can be given the appearance of expensive ultramodernism with the aid of nothing more than a ten-cent mirror or a piece cut from a broken mirror of better quality.

Remove the mirror from its frame and with a razor blade scrape away enough silver to form

a window for the face of the old clock. Next cement a piece of cut-out plywood or pressed composition wood to the back so that the clock can be attached securely.

The final touch consists in flowing the face of the mirror with thin transparent lacquer that has been colored a light shade of either blue or green. The edges of the glass may be trimmed with black enamel.—E. A. BOWER.



Jig-Sawed Scotties for Dress Ornaments

I HAVE found a ready sale for Scottie pins. They are jig-sawed from walnut or maple, and the design is burned in with an electric pen. The collar and nose tip are painted red, and the whole given three coats of shellac, with a light sanding between coats. The clasp is made by driving a bent pin into the wood and then soldering a small safety pin to it, although commercial fittings are preferable. The same design, enlarged or reduced, will serve for making buttons and buckles.—JOHN W. CARSON.



Coal Bin Dressed Up at Trifling Cost

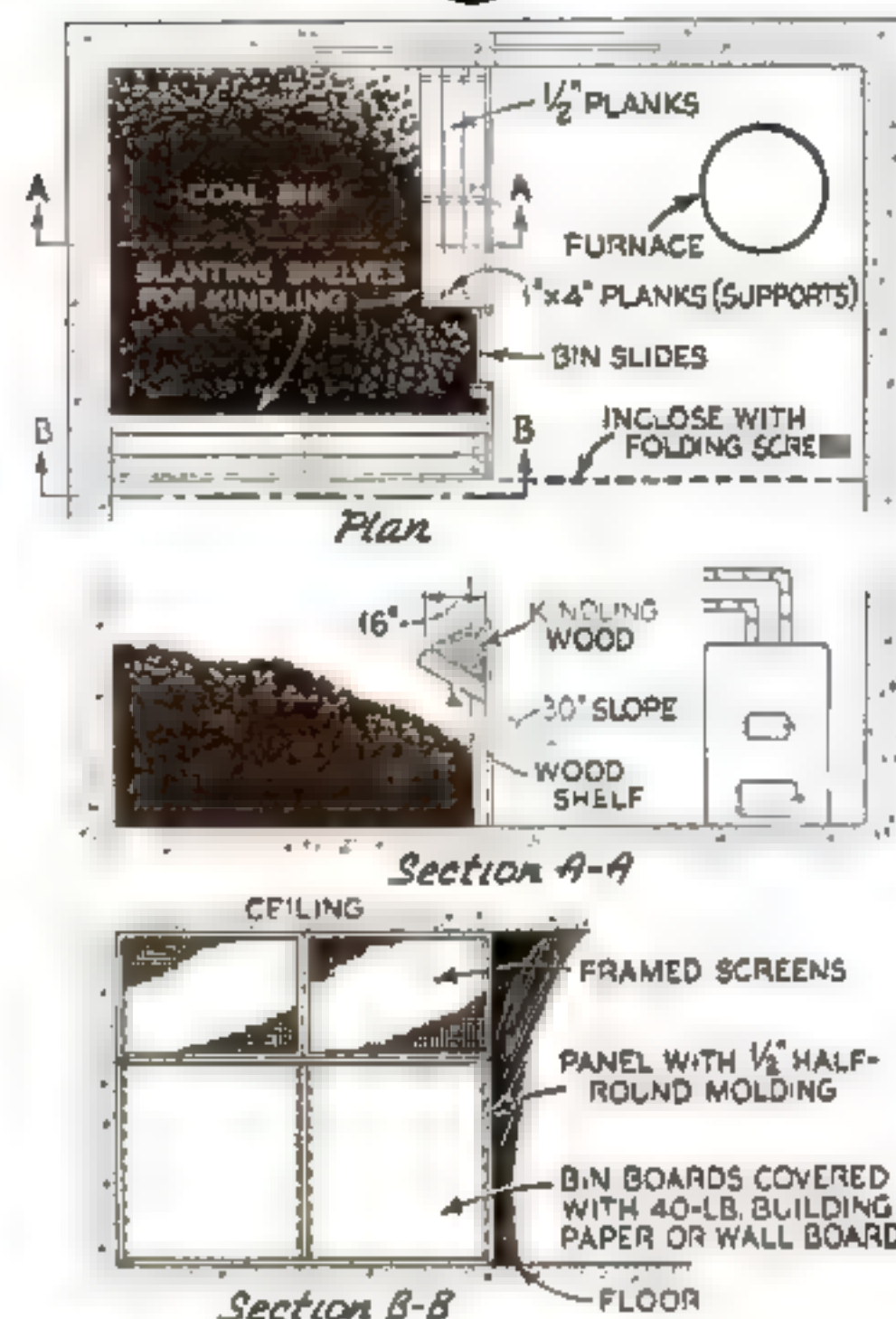


Cellar recreation room and, at right, plans for a similar alteration

AN INEXPENSIVE way of partitioning off a recreation room in an ordinary cellar is suggested in the accompanying illustrations.

The coal bin in this case was covered on the outside with very heavy building paper (40 lb. to a roll) and trimmed with $\frac{1}{2}$ -in. half-round molding strips.

Wall board could, of course, be used to advantage in place of the paper. A varnish primer was applied, and the bin then painted. The open space above was covered with insect screening to allow free circulation of air. These screens were hinged at the top to give easy access to slanting wooden shelves on the inside of



the bin near the top, which were provided for the storage of kindling wood.

The open space between the cellar wall and the coal bin, where the furnace is located, is shut off with a light folding screen, although it could almost as easily have been partitioned with wall board.—LAWRENCE N. OLSEN.

Welding Reduces Cost of Large and Unusual Tools

WHEN a special tool is needed for a repair job in the machine shop or garage, it is sometimes possible to save expense by welding a coat of high-carbon steel on the outside or working parts of a machine-steel body.

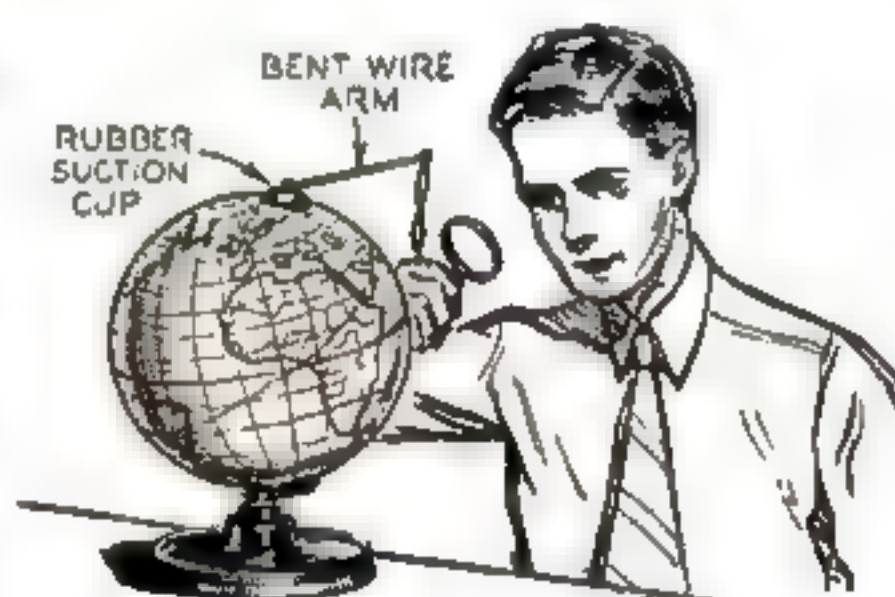
For example, in the auto mechanics department of the Elkhart, Ind., High School, we required a special tap for use in repairing a motorcycle. A piece of machine steel was turned to the general form of a tap; then I welded on a coating of high-carbon steel (drill rod), annealed it, replaced it in the lathe, cut the proper number of threads, and hardened and tempered it. It would have cost much more to have had a tap made in a tool room.—JAMES A. FOSTER.

Making Stepladders Safer

PIECES of slate-surfaced roofing, if tacked on the steps of a stepladder, will make it safer, especially in rainy or snowy weather. When a ladder is to be used for puttying, painting, or washing windows, a board about $\frac{3}{4}$ by 3 in. by 4 ft. long may be bolted across the top so that it spans or bridges the windows. It is then unnecessary to lean over to do the work.—ARTHUR L. KASER.

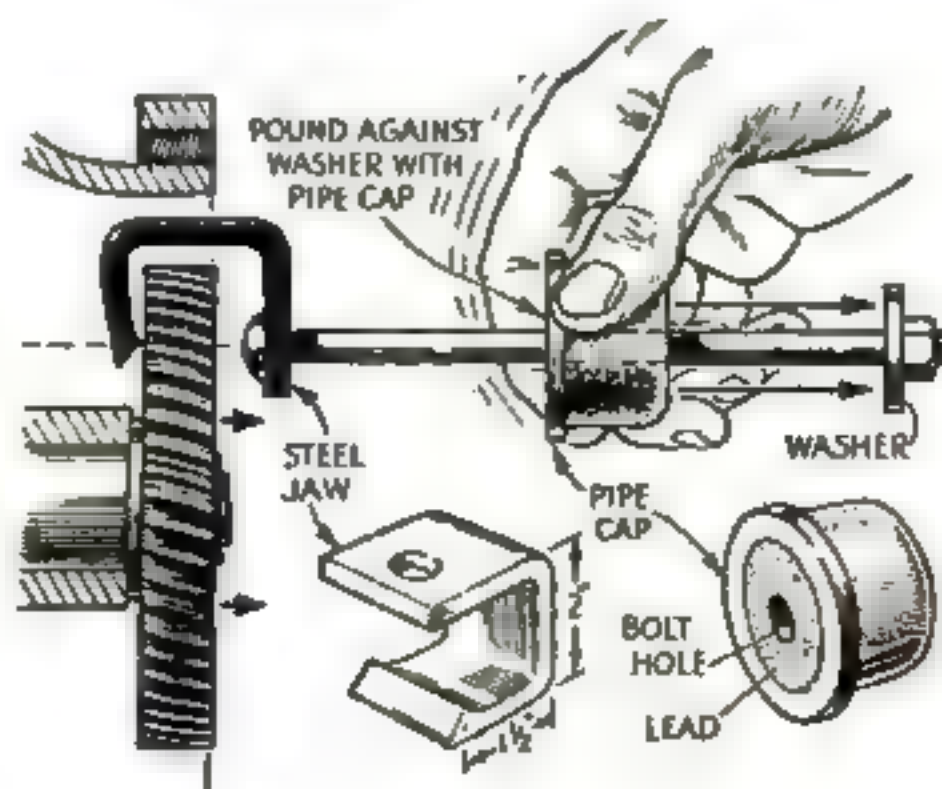
Magnifier Fastened to Globe with Rubber Suction Cup

TO AVOID the difficulty many children experienced in locating small names printed on a terrestrial globe, one school teacher obtained a rubber vacuum cup, a length of wire, and several rubber bands and assembled them to suspend a small magnifying glass as shown. The wire arm is fastened between washers so that it can swing around.—G.E.H.



The glass is always handy for reading the small names printed on the globe

Pulling Tool Has Self-Contained Hammer



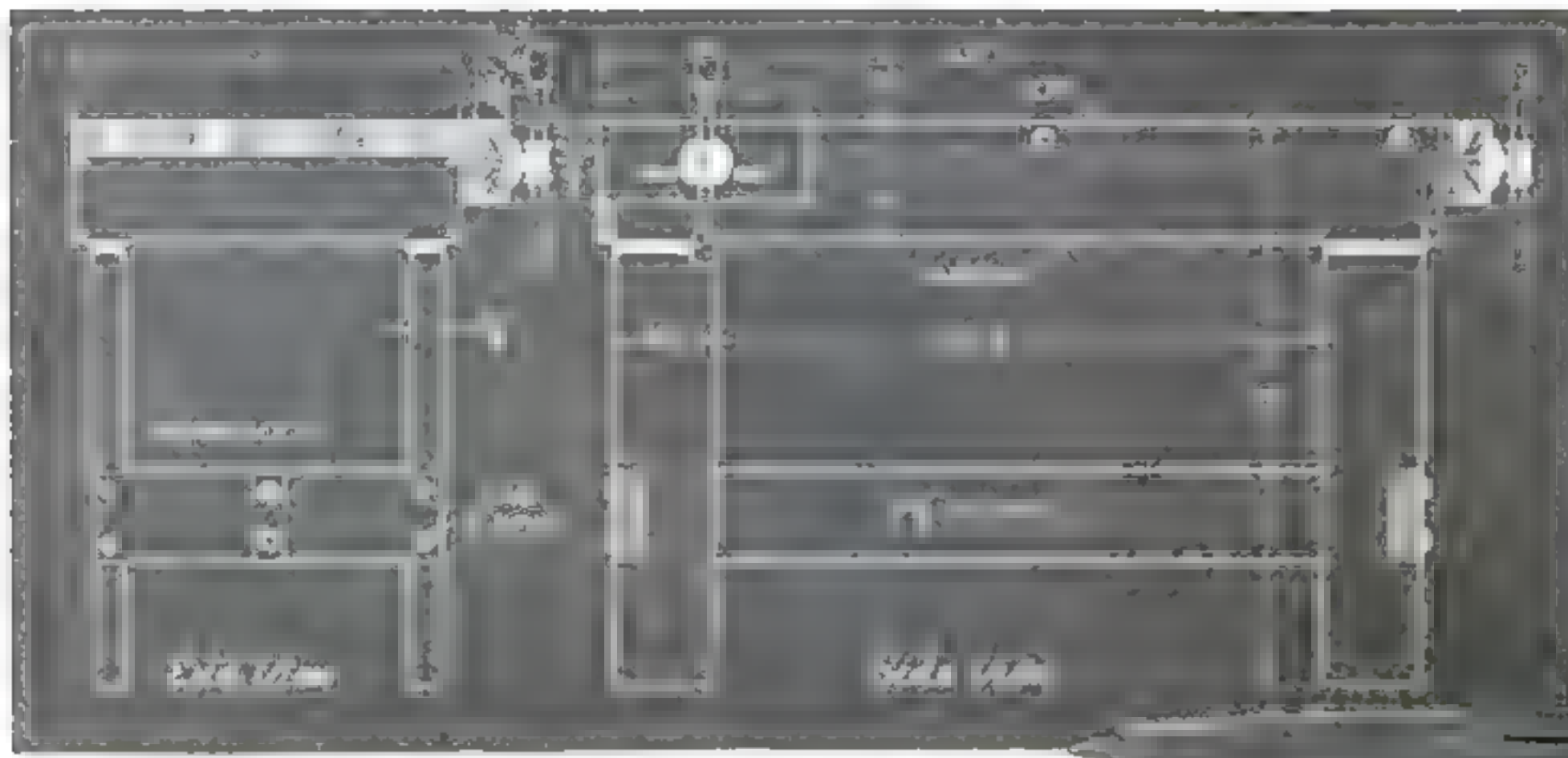
ORIGINALLY designed to pull off timing gears, this homemade tool worked so well that it has a permanent place among my hand tools. It can be used for removing gears, axles, sticking valves, bearing caps, cylinder heads,

grease retainers, and other parts, especially the pitman arms on steering assemblies.

The tool consists of a 10-in. carriage bolt, nut, and washer, a 2-in. pipe cap filled with lead and drilled through the center, and a jaw. The latter can be of strap iron, but is best made from an old auto spring by utilizing the center hole already in the spring.

The jaw should be shaped while a salmon red. The "bite" is formed by upsetting the edge with a heavy hammer, and it is then filed sharp while the metal is still red-hot. The entire piece is brought to a uniform cherry red and quenched, when purple, in cold water until black. It is allowed to finish cooling slowly, thus slightly annealing it.

In use, the jaw is hooked over the part to be removed, and sharp blows are struck with the weight until it becomes loose.—T. W. BOYD.



By
J. I. SOWERS

An economical design for a woodworking bench. Mr. Sowers, who developed the plans, is supervisor of industrial education in Miami, Fla.



Home Workbench

HAS EVERYTHING YOU NEED

A GOOD workbench! That's the very foundation of a home workshop—the first necessity of all amateur craftsmen.

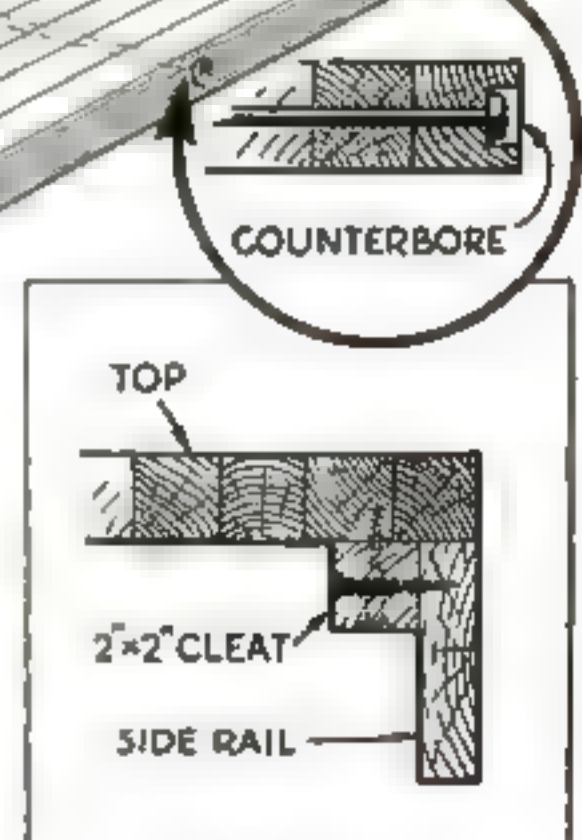
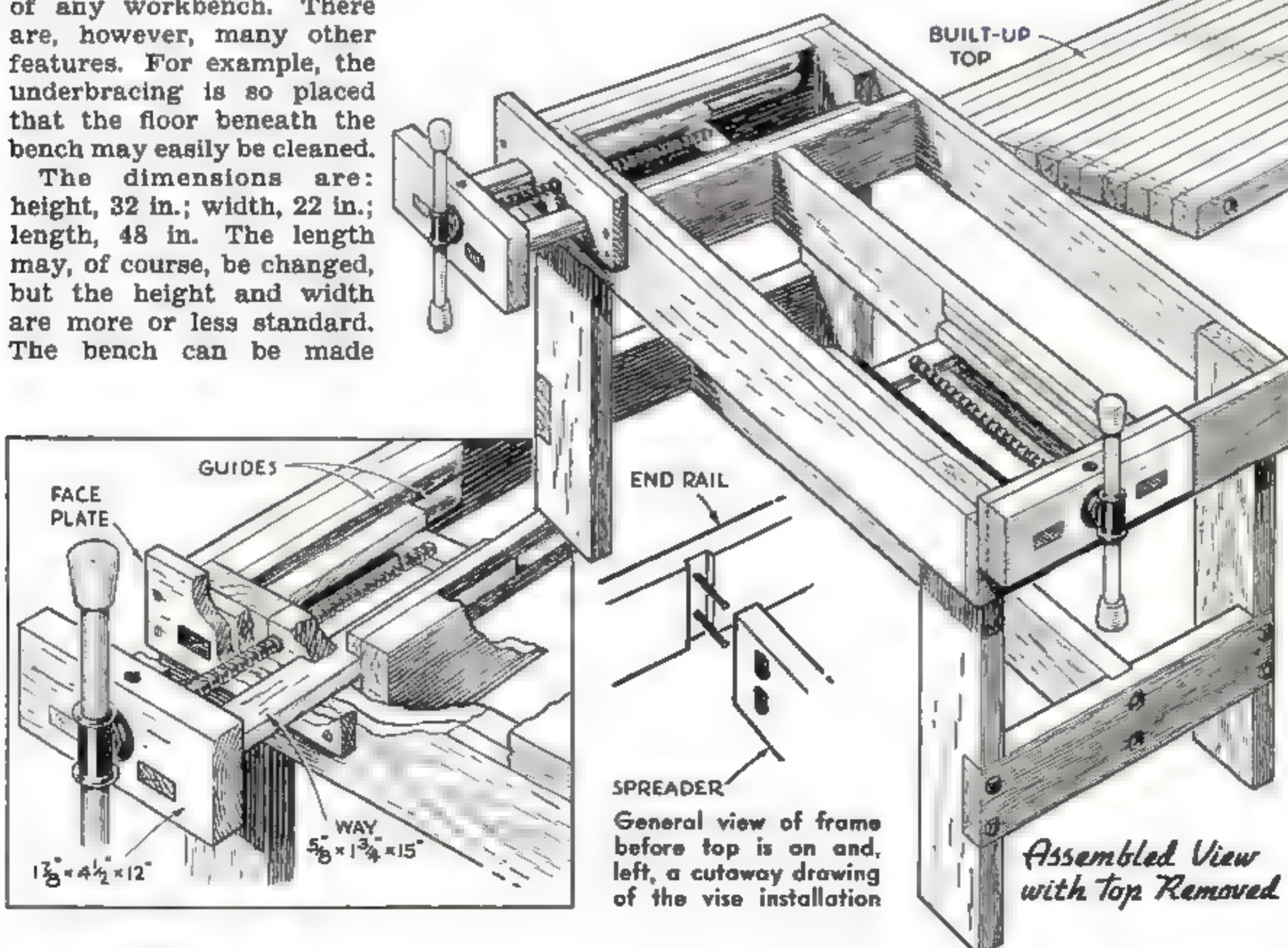
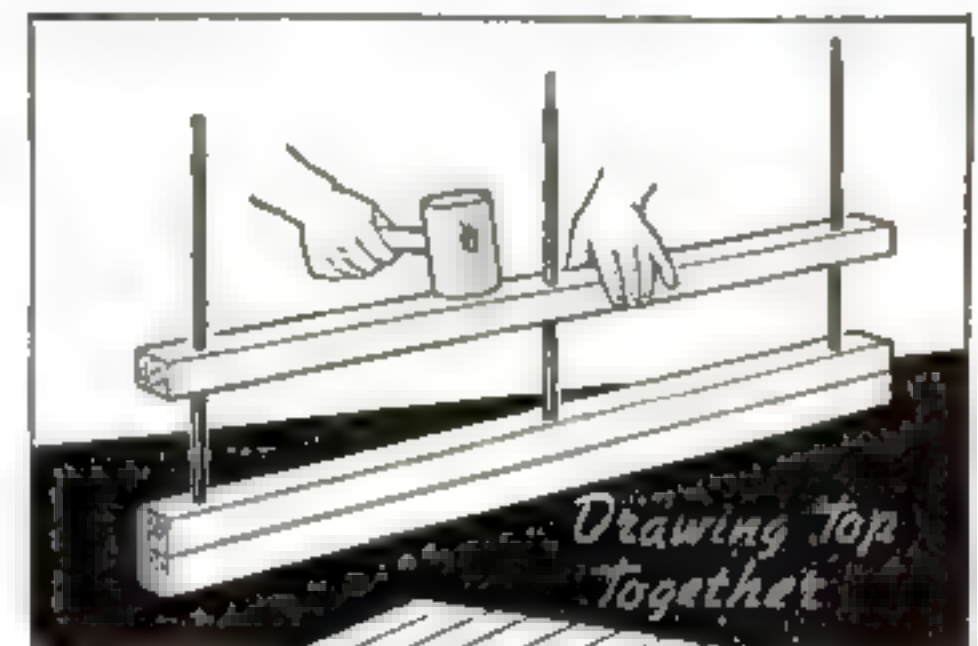
The bench illustrated is, I believe, just the type that home woodworkers need. It is the last word in economy, yet as satisfactory as any bench made, regardless of price. Special attention is given to the top and the two vises, for these are the vital parts of any workbench. There are, however, many other features. For example, the underbracing is so placed that the floor beneath the bench may easily be cleaned.

The dimensions are: height, 32 in.; width, 22 in.; length, 48 in. The length may, of course, be changed, but the height and width are more or less standard. The bench can be made

higher if the worker is tall or if only light, delicate work is to be done.

Yellow pine may be used throughout, except for the jaws and faceplates of the vises, which should be oak or maple. The list of materials is more or less tentative, since most of the sizes may be modified to suit available materials or variations in construction.

Mortise- *(Continued on page 132)*



The top is preferably made of a number of strips bolted together as shown above. One of the simplest ways of fastening it on is by means of two cleats

Built-in Fittings for

BUILDERS have a habit of slighting clothes closets, yet they should be planned as carefully as a kitchen or a bathroom. One way of improving closets is, of course, to install any of the various closet-door racks, shoe racks, hanger arms, and other commercial fixtures.

If room is available, however, a still better method is to construct built-in cabinets. They can often be placed in closets without greatly reducing the hanging room on the walls, and they add much drawer and cupboard storage room.

A typical small cabinet, which can be changed in width and depth to fit narrow or wide closets, is illustrated on the facing page. It is designed so the front and back can be assembled outside the closet. If the closet door is at the side rather than the end, the entire cabinet may be built and finished outside, then slid into position.

Order the lumber sized four

sides (S4S) and sanded. The drawer sides are of proper width to fit corresponding front material, and the bottoms are cut from three-ply wall board, which is also used for the top, back, and various other parts.

Lay out a front corner stile or upright member, beginning at the top, and set out the widths of the rails as they come, allowing drawer openings equal to the width of the drawer sides plus $\frac{1}{8}$ -in. clearance. The feet should be long enough to take a 1 by 4-in. baseboard with the bottom drawer rail projecting $\frac{1}{4}$ in. above. Use this first stile as a pattern for the others.

Glue and nail short blocks to the insides of the stiles to support the

drawer rails and slides. Notch the rail ends to lap 1 in. behind the stiles. In figuring the width of the cabinet, allow at least $\frac{1}{2}$ in. for clearance—more if the closet walls are irregular or out of plumb. The partition post (muntin) laps behind the upper rail and butts against the second from the bottom, while the short drawer rails lap on the stiles and butt against the muntin.

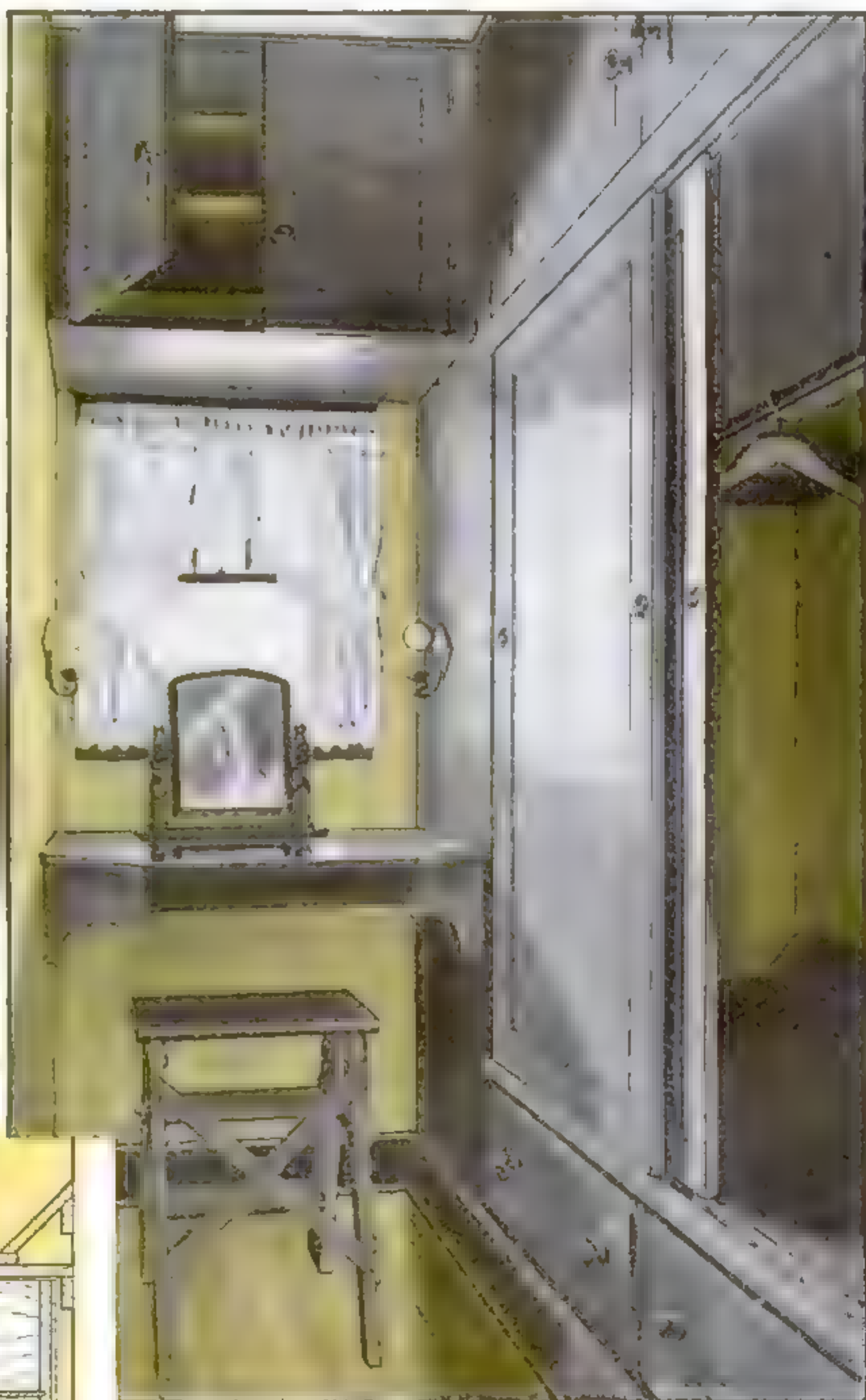
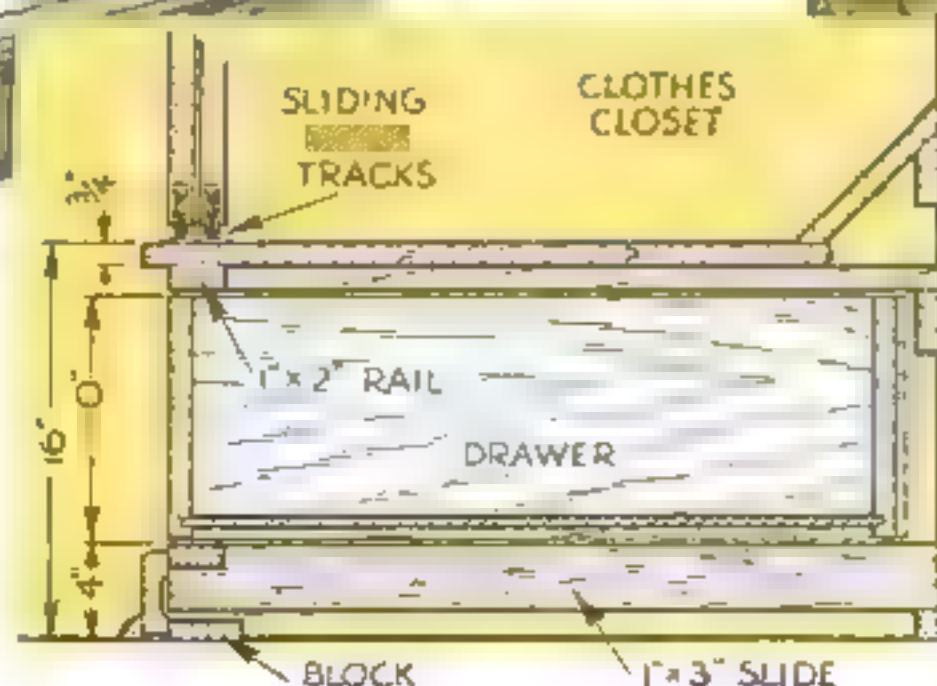
After gluing and nailing the front and rear frames together, square them, and tack a strip of wood diagonally across each to keep it from shifting. Also assemble the slide-guide parts.

Lip drawers are used for this cabinet, as they eliminate the difficulty of making flush fronts fit neatly. Make

In some cases a cabinet can be assembled outside the closet and then shoved into place as illustrated below



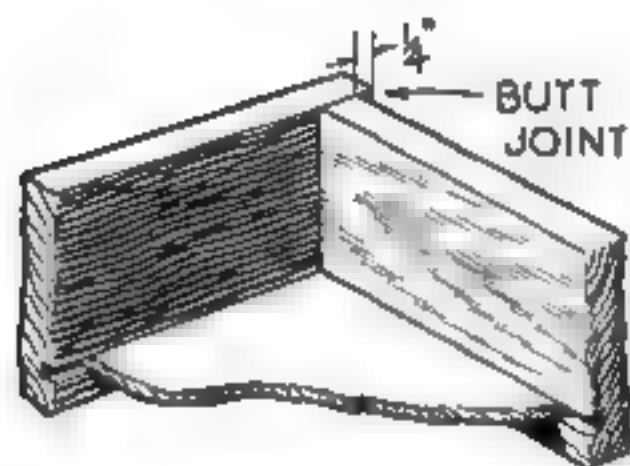
The sectional view at the right shows the construction at bottom of the wardrobe with sliding doors



A large closet improved by building a wardrobe and dressing table

CLOTHES CLOSETS

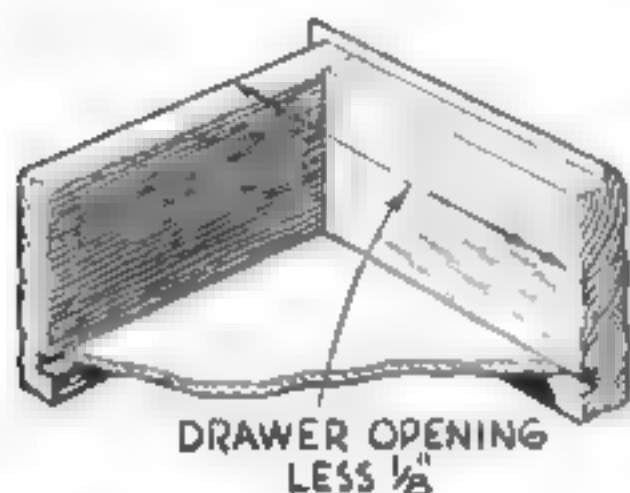
By
EDWIN M.
LOVE



Easy Construction



Rear Drawer Corner



Front Drawer Corner

the door frame with lapped corners and sheath it with plywood, fitting the frame and cutting the three-ply to show a lip on sides and top. Hang with offset surface hinges.

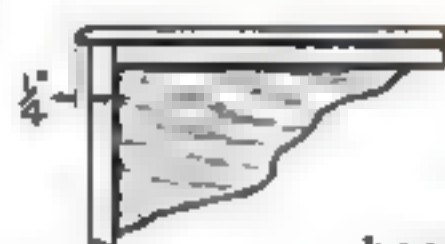
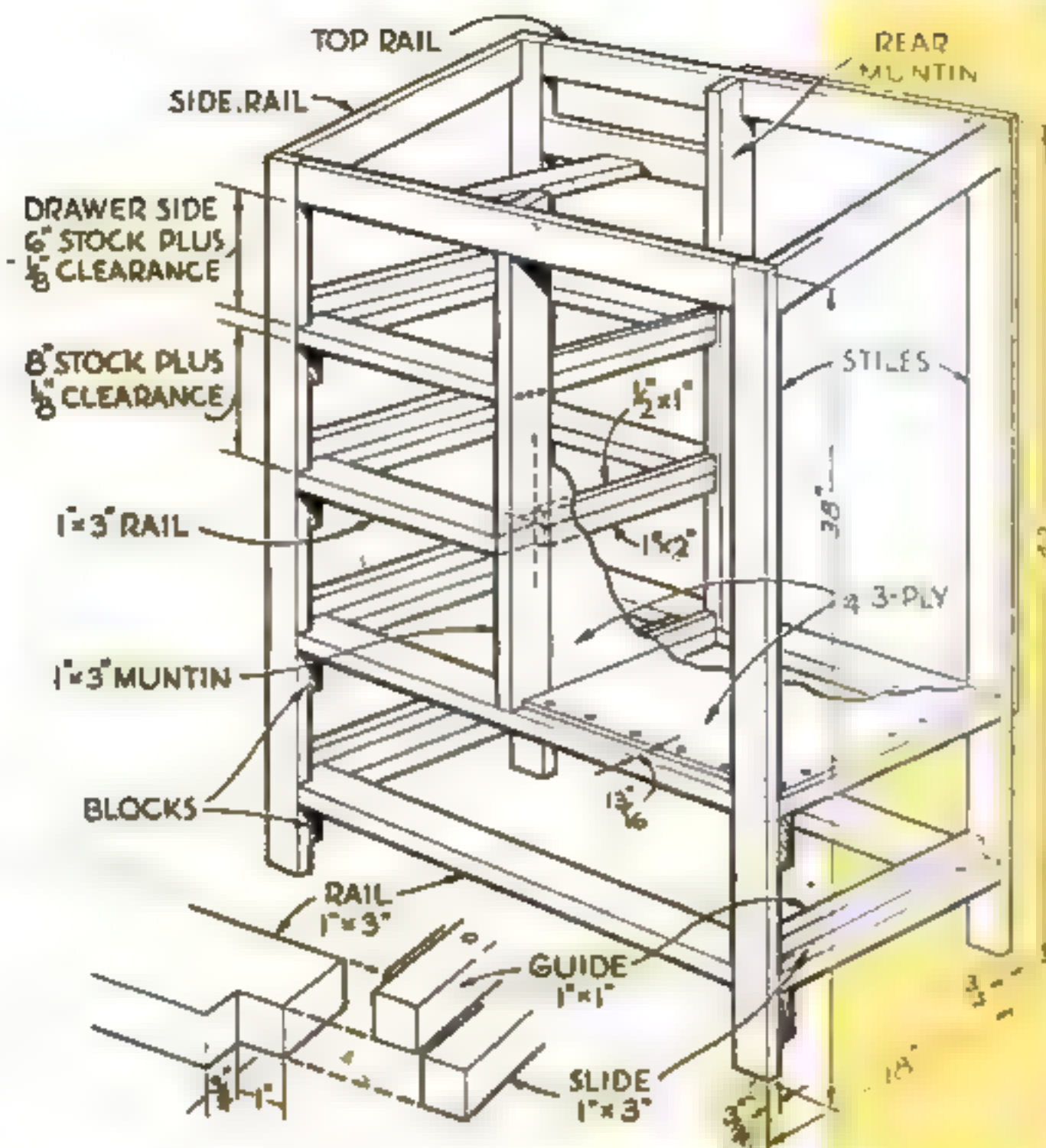
After assembling the cabinet in the closet, install it by wedging it between the walls with blocks. Toenail through them and into the floor after leveling and plumbing. Nail the top in place and fit a small quarter-round or other narrow strip around the cabinet against the wall, closing the joint.

Nail a hook strip around the closet 5½ ft. above the floor. Hanging capacity is greatly increased by the use of folding notched hooks, capable of holding up to six hangers, rather than the common single hooks.

Of course, shelves should be put at both ends of the closet. End cleats leveled and nailed to the walls are sufficient if the shelf is of 1-in. stock. The boards should be kept away from the back wall about ¼ in. to facilitate cleaning.

Instead of racking shoes on top of the chest, metal cabinets for shoe storage can be purchased, or suitable ones built from wood.

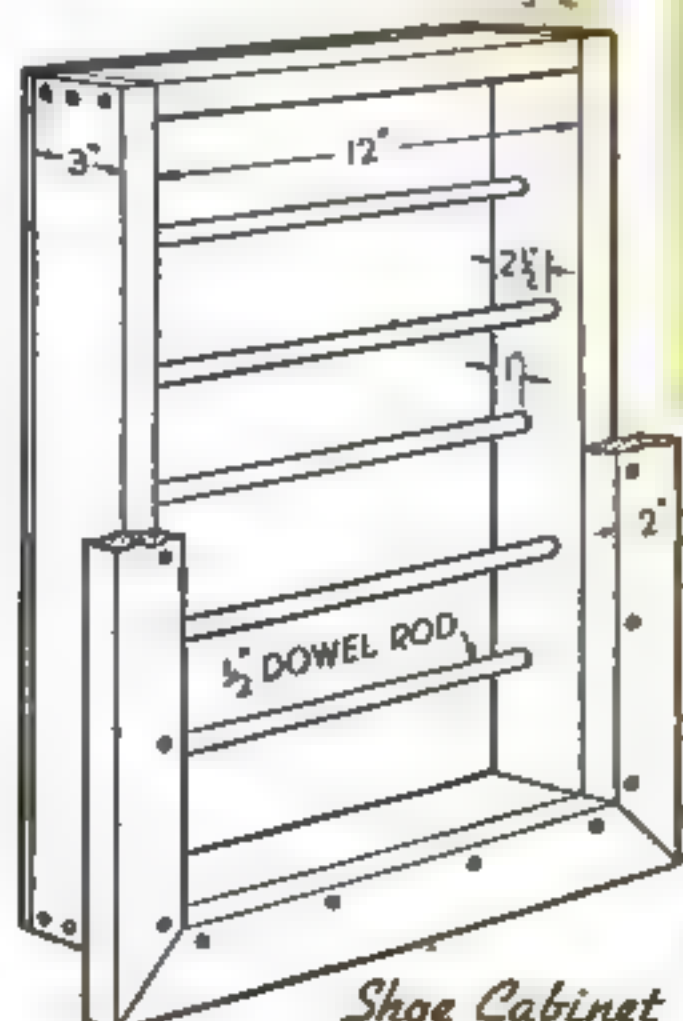
If the closet happens to have a window and is about 4 ft. wide and 5 ft. long, an excellent arrangement is to build a wardrobe along one side with a dressing table under the window. The floor of the wardrobe is made 16 in. above the closet floor, and the back



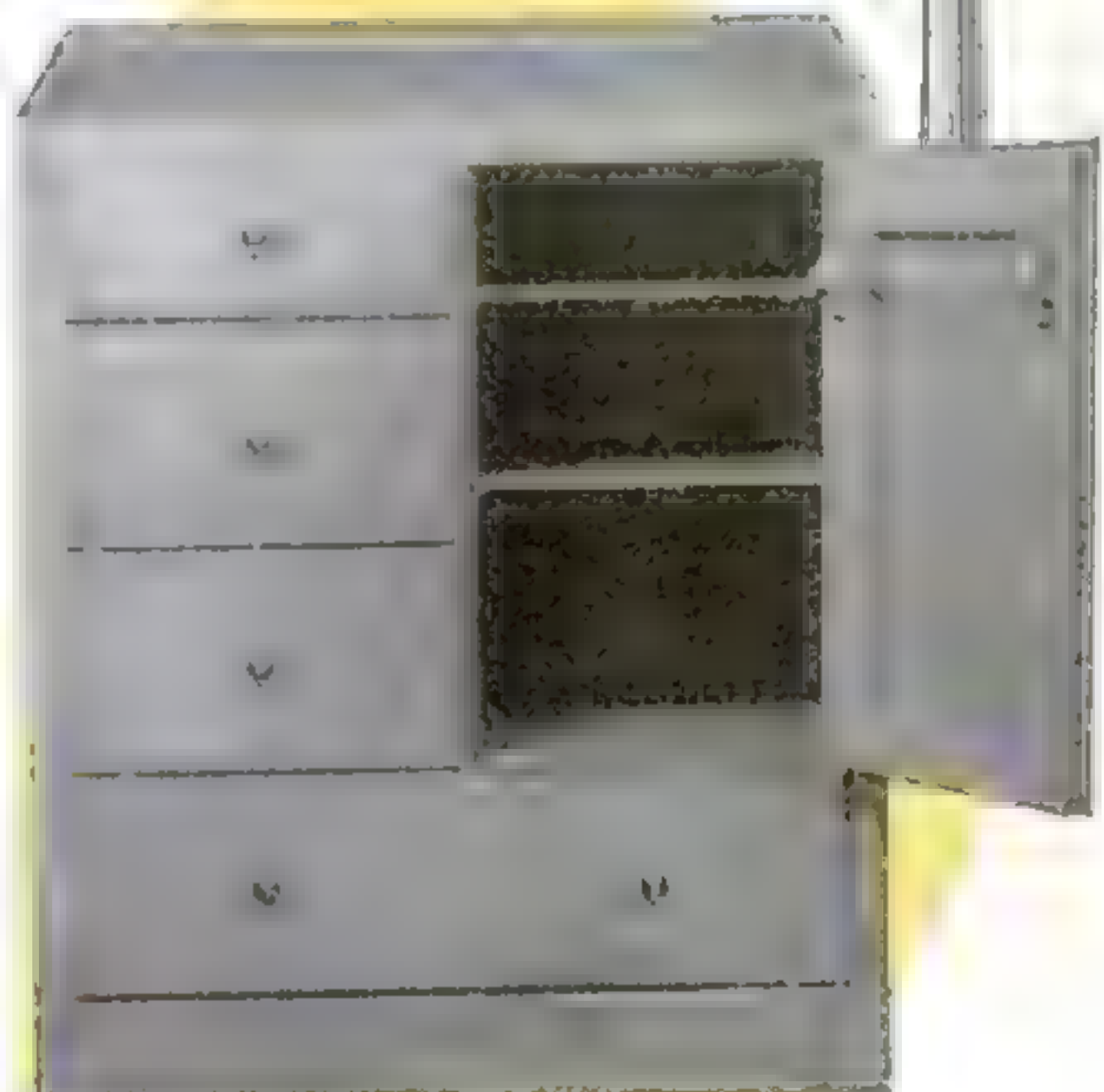
How the cabinet framework is built. Left, drawer construction. Right, the installation

board is inclined upward at the bottom to make cleaning easier. Drawers are built underneath. Shelves above, closed by doors, make good cupboards for bedding. If sliding doors are used for the wardrobe, as shown on the opposite page, install the outer door to clear the inner one by approximately 1/16 in.

The dressing table need be nothing more than a shelf carried on wall cleats, with an ornamental apron in front.



Shoe Cabinet



The finished cabinet. The wood was given one coat of thin flat white paint. This was lightly sandpapered and glazed with brown, which was wiped off while wet to give an antique effect. After this had dried, flat varnish was applied

Left, a shoe cabinet that fits into a hole cut in the wall between studs. To gain depth, it may be necessary to knock the plaster keys off the lath

IT DOESN'T COST MUCH

Stage



Back of panel and, fastened at one end of suitcase, a bell, buzzer, and transformer

DO YOU feel that your club's amateur dramatic productions are losing some of their appeal because you haven't been able to obtain the proper lighting equipment?

Yes, you may answer, but we haven't the money to buy expensive equipment, so what can we do about it?

Here's what you can do, you amateur electricians: construct your own switchboard and stage-lighting set. The board proper shouldn't cost more than ten dollars.

The first thing to do is to get enough galvanized iron to make a box and panel, or if you prefer to have the outfit portable, it may be placed in a small suitcase 21 by 12 by 5½ in. If you use the suitcase, reinforce it with a strap-iron frame that will slip inside. A metal box has the advantage over the suitcase that it makes the set fireproof and shock-proof when provided with a proper ground wire.

All the equipment, with the exception of the board light, will be bolted directly to a panel cut from five-ply wood. Fasten this light to the back of the case so that only the top portion of the bulb extends through the hole in the panel. The wiring is all on the underside of the panel, so if repairs are necessary at any time, the panel with the frame can be pulled out of the case. Get some sheet asbestos and put it on the bottom of the panel as well as inside the case between the frame and the wiring, where its use is most important.

There will be three main control sections on the switchboard. The

first is the footlight section. This should consist of four individual units, all having the same common return wire. Each unit may be either dimmed or cut completely, or the whole section may be dimmed and cut by one switch and dimmer.

The second section is for special lights such as spots, floods, and overheads. The flexibility of this unit is the same as that of the footlights.

The third section is for the purpose of producing effects such as lightning, bells, telephones, and horns. A push-button switch in the 110-volt circuit provides for the lightning, while a 6-volt transformer with adequate push-button switching affords proper voltage for bells.

The capacity of the board, while not over 25 amperes, is adequate for general use. A No. 10 wire is suggested, but the capacity can be made larger by using a larger wire.

The footlight cable, which must be designed especially for use with the board, is made of five individual wires twisted together, one being the common return.



Wiring diagram, panel layout, and below, the finished switchboard



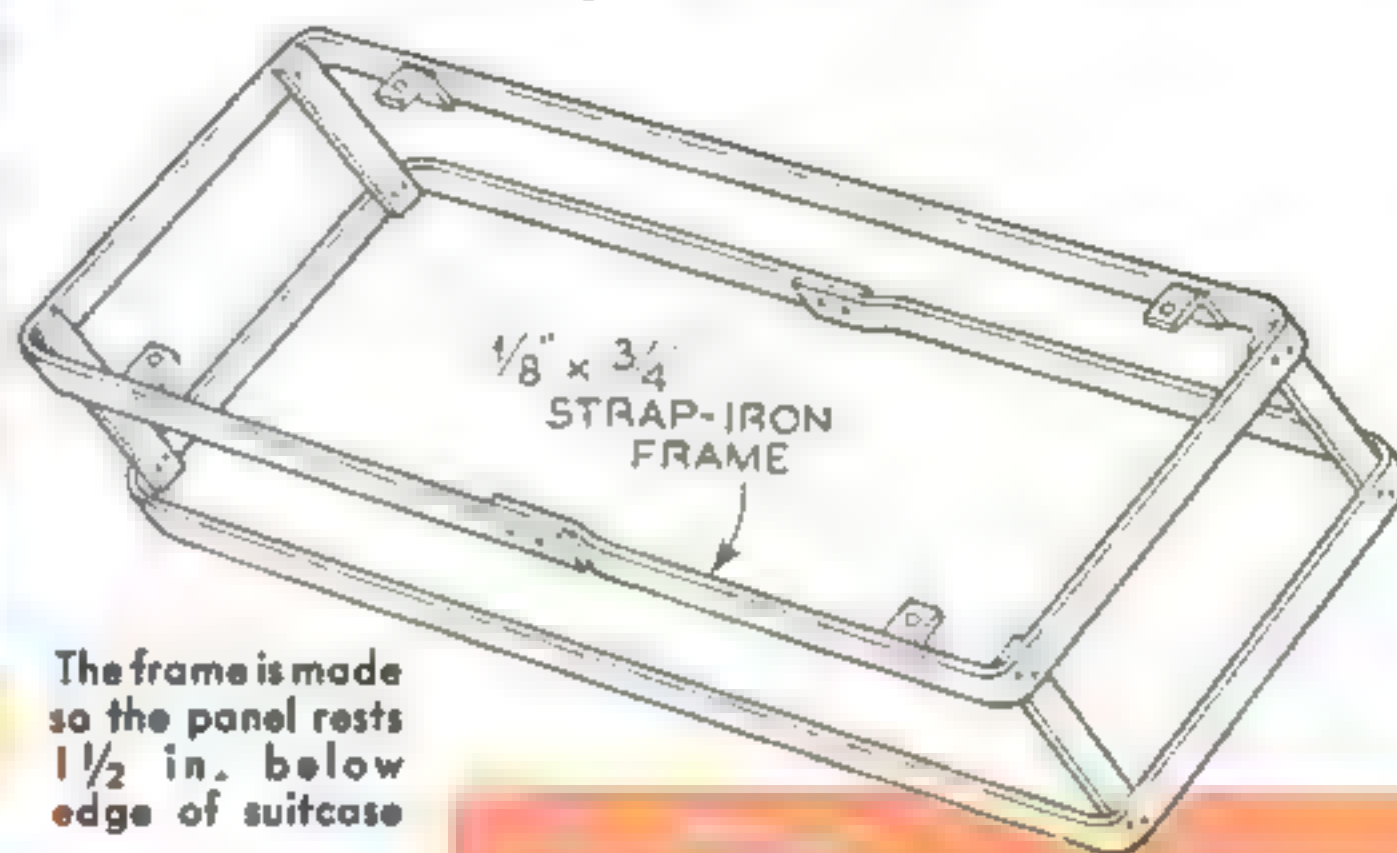
TO MAKE YOUR OWN

Lighting Equipment



Ease of construction, flexibility, ruggedness, portability, low cost, and safety are among the features of the amateur stage lighting equipment illustrated in the accompanying article. The switchboard has been used very successfully by Wesley Players, an amateur dramatics society conducted by students at the universities of Wisconsin and Purdue

By M. M. WOODSON



The frame is made so the panel rests 1 1/2 in. below edge of suitcase

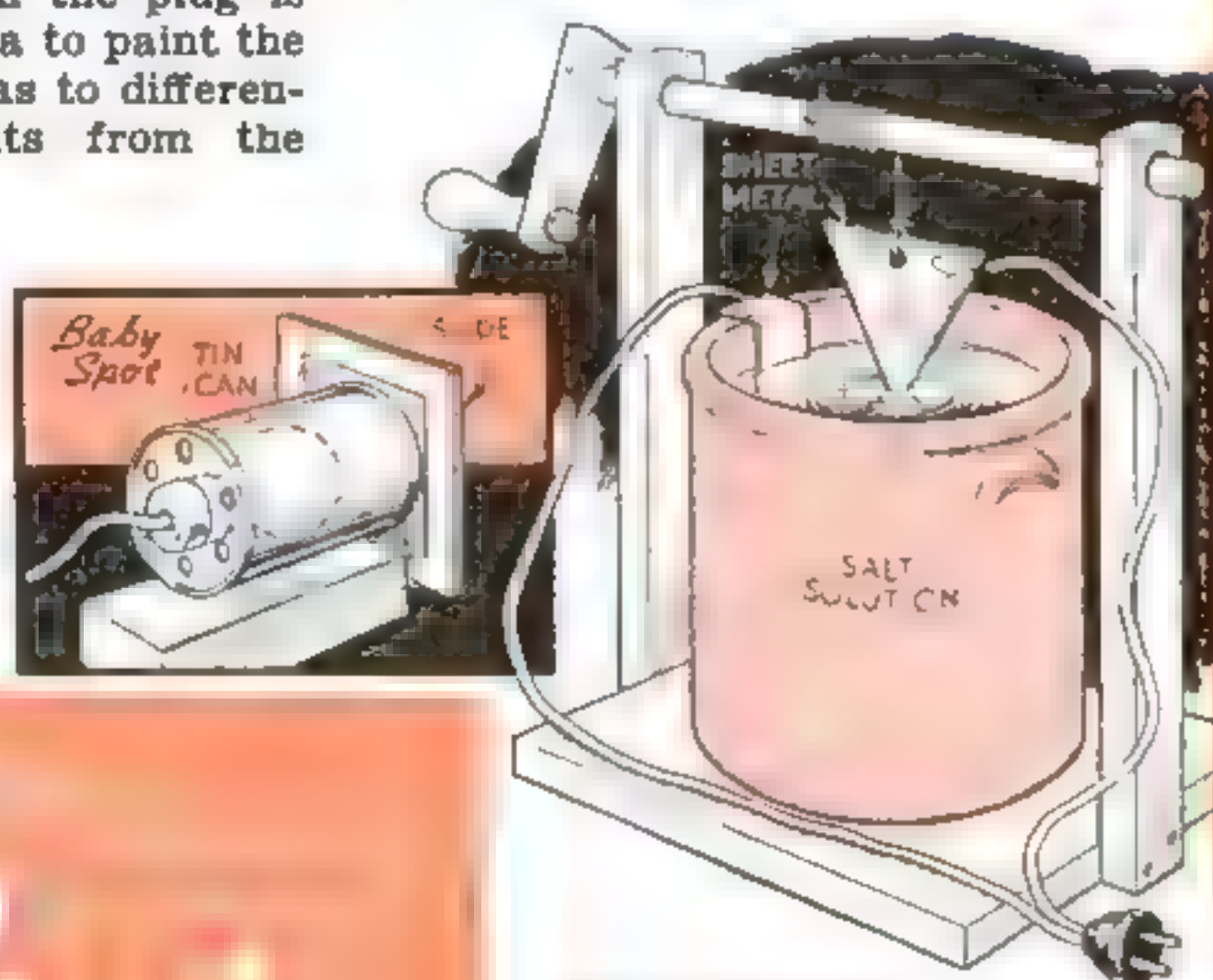
At 20-in. intervals, short leads to the sockets should be tapped on to each of the four circuits in rotation. Make them any length you wish.

Plugs in this footlight cable are ordinary two-prong male plugs with both prongs—and this is important—fastened to the one wire to which the plug is attached. It is a good idea to paint the plugs different colors so as to differentiate the several circuits from the common return.

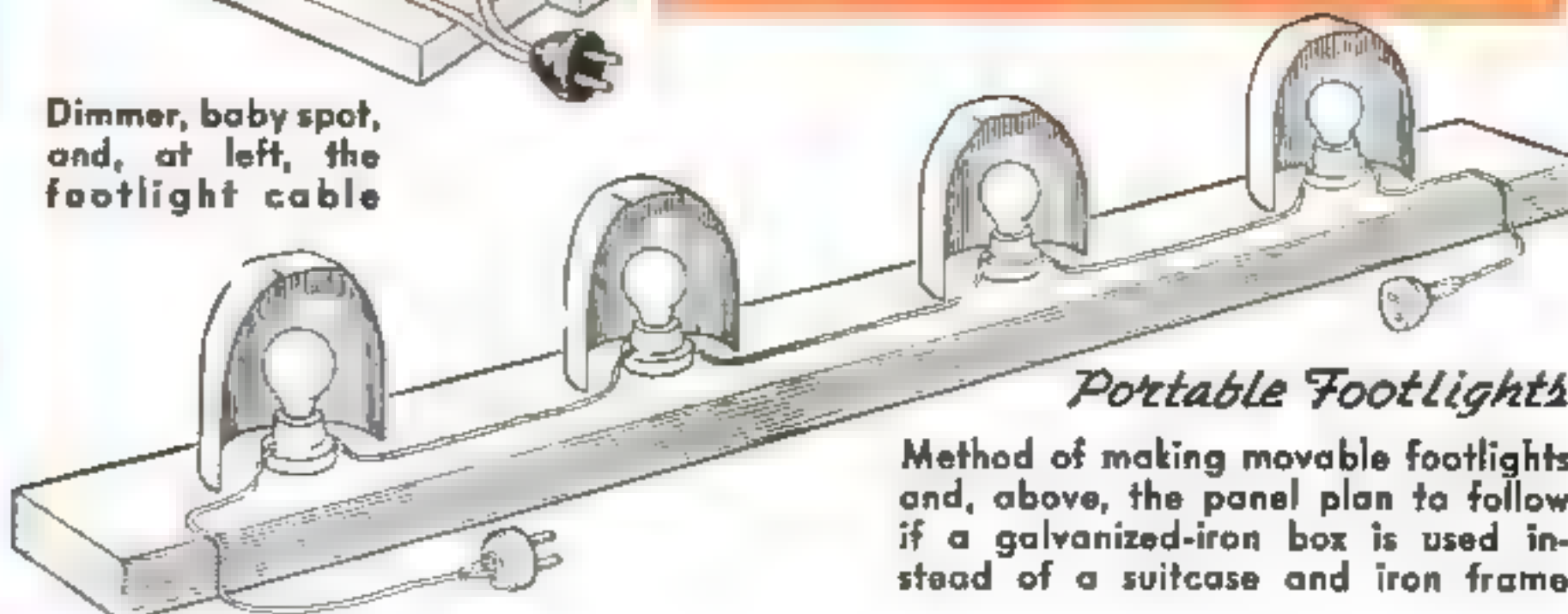
The special-light leads consist of common lamp cord of sufficient capacity.

For dimmers, one small, comparatively high-resistance wire dimmer may be used

where the current is not too great; where the power handled is higher, a variable impedance coil can be used with less heat dissipation. This can be made by winding a helix of No. 12 magnet wire, and binding *(Continued on page 135)*



Dimmer, baby spot, and, at left, the footlight cable



Portable Footlights

Method of making movable footlights and, above, the panel plan to follow if a galvanized-iron box is used instead of a suitcase and iron frame

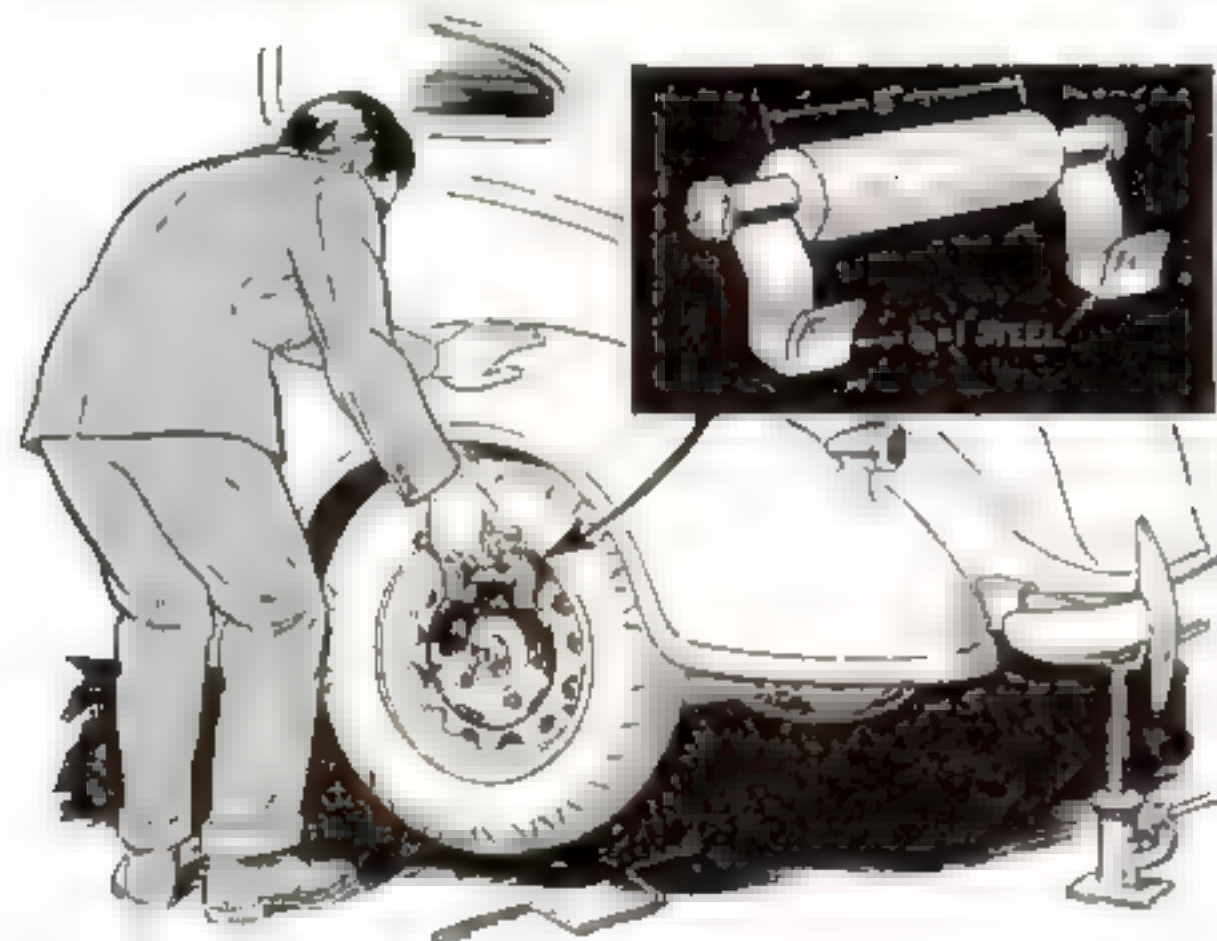
Auto Ideas

A PAGE OF HANDY KINKS FROM
CAR OWNERS THAT WILL SAVE
YOU BOTH TIME AND MONEY

Light Switch Is Mounted on Garage Door

GROPING in the dark for the light switch in a dusty garage is a sure way to ruin a good suit of clothes. To put the switch where it could always be found, even on pitch-black nights, I mounted it on the garage door at about shoulder height. The switch is connected to the lighting circuit with flexible armored cable; a good-sized loop of the cable between the door and wall being provided

to eliminate any possible strain on the wire when the door opens and closes. The cable should be of the weatherproof type to avoid possible short circuits in rainy weather. The device also simplifies leaving the garage after the car is put away.—E. H.

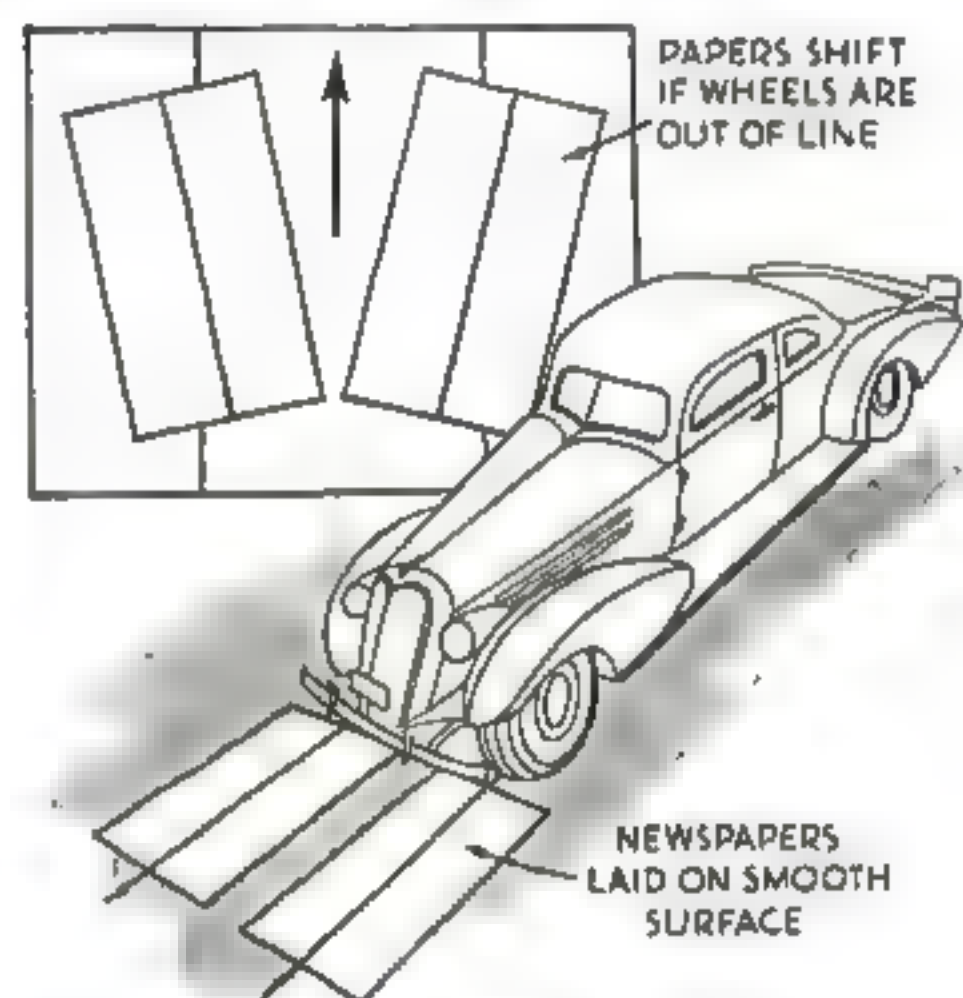


Handle Aids Changing Tires

A SIMPLE handle like the one being used in the picture above will make it easier to lift a modern pressed-steel wheel into place when changing a tire. It is assembled from a long bolt, two sheet-metal hooks, and a wooden handle.—E. T. G.

Papers Check Front-Wheel Alignment

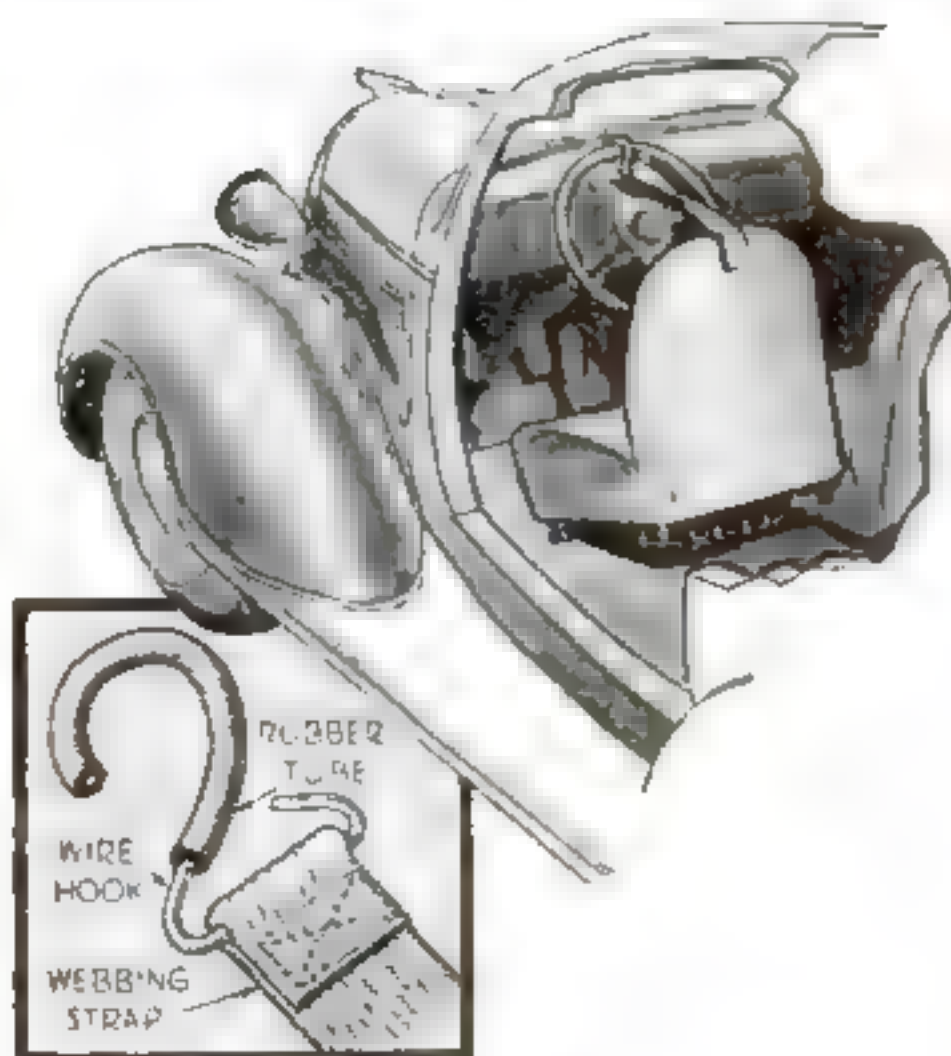
INCORRECT front-wheel alignment, which causes rapid tire wear and shimmy, can be checked by applying the principle of elaborate service-station machines to a pair of newspapers. Place them on a clean, smooth surface, as shown in the illustration at the right, then make chalk marks on the papers and the pavement to indicate their exact positions. Drive the car's front wheels over the sheets, and note if they have moved. If so, it indicates that the toe-in is not correct and the tie rod should be adjusted. Repeated experiment should bring the wheels into alignment.—F. O.



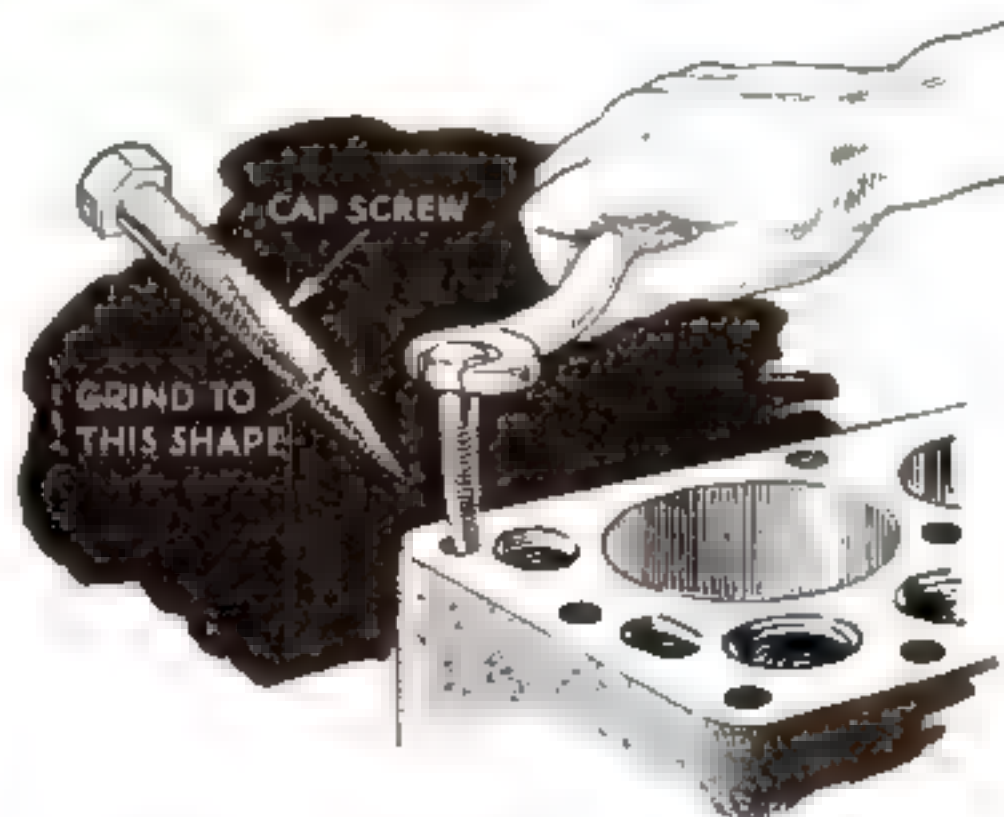
The papers at top moved when car drove over them, showing that the wheels are out of line

Hook Holds Up Front Seat of Coach

REAR-SEAT passengers can get in and out through the left-hand door of a two-door sedan more conveniently if some means is provided to hold the driver's seat away from the entrance. For this purpose, I use a fabric strap fastened to the back of the front seat. The opposite end is equipped with a heavy wire hook that fits over the steering-wheel rim. To keep it from slipping and marring the surface of the wheel, the hook is covered with rubber tubing. The hook will be found particularly useful by shoppers.—L. V. H.



The driver's seat will remain in a raised position if fitted with a hook and strap



Dirt and corrosion are removed from studs holes of an engine by the use of this homemade device. It consists of a cap screw filed to a long point

Pointed Bolt Cleans Out Threads

BREAKAGE of cylinder-head studs when they are being replaced after an overhaul job can be eliminated by cleaning out the threaded holes in the cylinder block. Take a bolt or cap screw of the same thread size as the studs, and file or grind it to a long bevel point. When turned into the hole, this reams out all dirt and corrosion that would cause the regular studs to stick and break.—A. H. W.

WE FINISH EQUIPPING OUR Whaleboat Model

By Capt. E. ARMITAGE McCANN

NOW that your whaleboat model is nearing completion, you must appreciate better why I said in the first article of this series (P.S.M., Sept. '37, p. 104) that the New Bedford whaleboat was the best designed for hair-raising adventure of any small craft in the world. Perhaps you have already looked into some of the many exciting books available about the whaling industry. At any rate, this is the time you should read, or reread, "Moby Dick." That stirring story will lend new enchantment to your little model.

Two knives were standard equipment on every whaleboat. They can be made from slips of tin with handles built up from solder and painted black. They lie in leather pockets, one on the cuddy board, the other on the bulkhead of the bow box. The ax is a piece of tin bent over the handle, soldered and sharpened; it rests behind the thwart clamp in the bow. All metal parts should be lacquered or varnished to prevent rust.

The harpoon crotch (see P.S.M., Sept. '37, p. 105) is a piece of bamboo, riveted through, then slit in three, with wooden wedges to keep the arms apart. The shaft goes through the cleat by the forward thwart and rests down on the thwart clamp. It might be made of wire, like the grapnel.

For the boathook end, use a piece of brass tube or rod. Cut it part way down and file it to two points, one of which is bent down to form the hook.

I made the boat spade from a piece of tin, soldered into a tin cone, which is slit at the point.

What is called the "waif" is just a red flag on a staff. Boats frequently carried three of these.

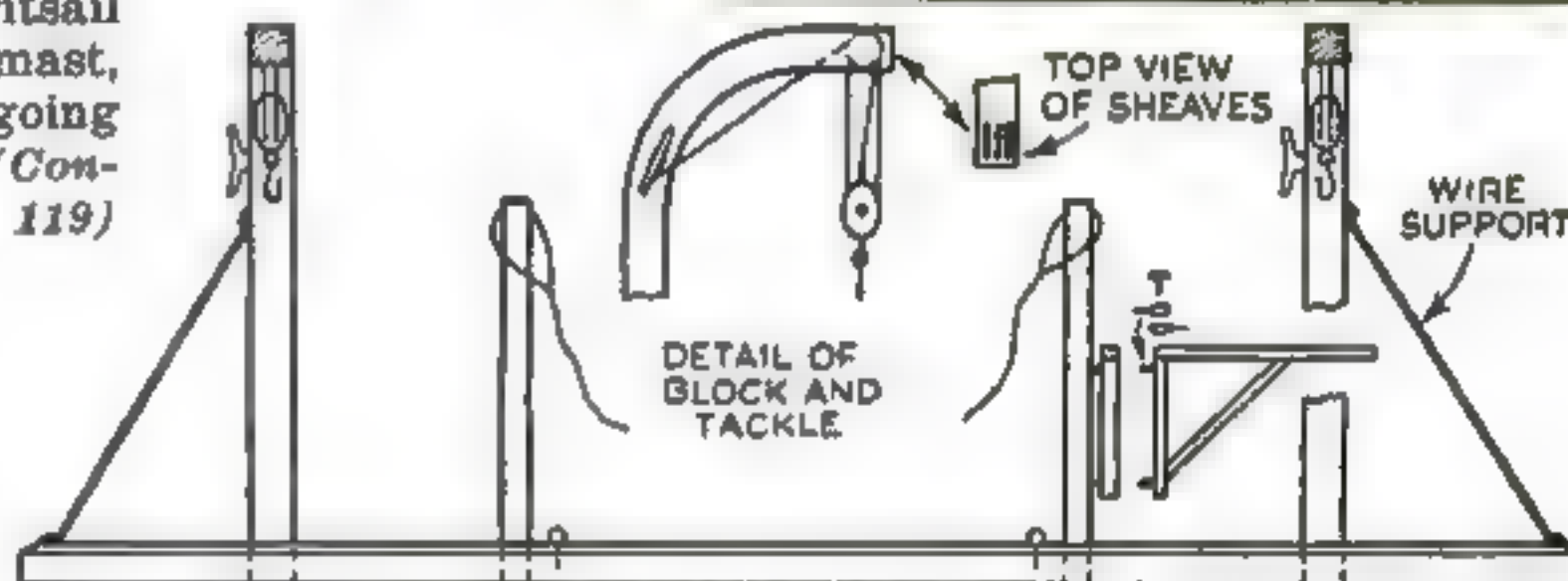
Oarlocks are of No. 20 wire, slightly flattened, with the U-shaped parts soldered to straight pieces for the shanks. They should have leather sewed on or be wound with thrum sennit, but because of their small size, I omitted this. They should have lanyards from one point to a rib. The fourth, or tub-oar, row-

lock is double so that when the line is being handled, the oarsman can use his oar above it.

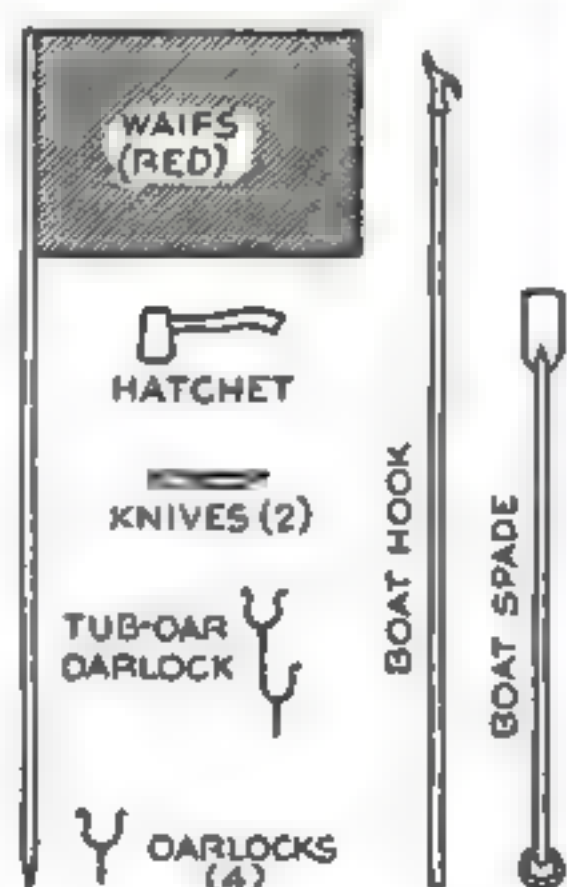
The steering-oar cleat (illustrated in the first article of the series) should be lined with thrum sennit, which can be made by hitching short pieces of cotton to two or three stretched pieces (the warp) and then trimming close to form a fuzzy cord like what is used to make a door mat. Make a knot (should be a Matthew Walker) in the end of a piece of cord, pass it up through the holes in the cleat and its upright, make an eye splice in the end, and fasten it to the cleat on the lion's tongue with a lanyard; between the holes it should be covered with leather or served. This is to hold the steering oar on the cleat, or brace.

Sails are cut from any thin material to the shape shown. They should have a narrow hem and then a thin cord stitched all around, with loops at the corners. The spritsail is laced to the mast, has a halyard going through a 3/16- (Continued on page 119)

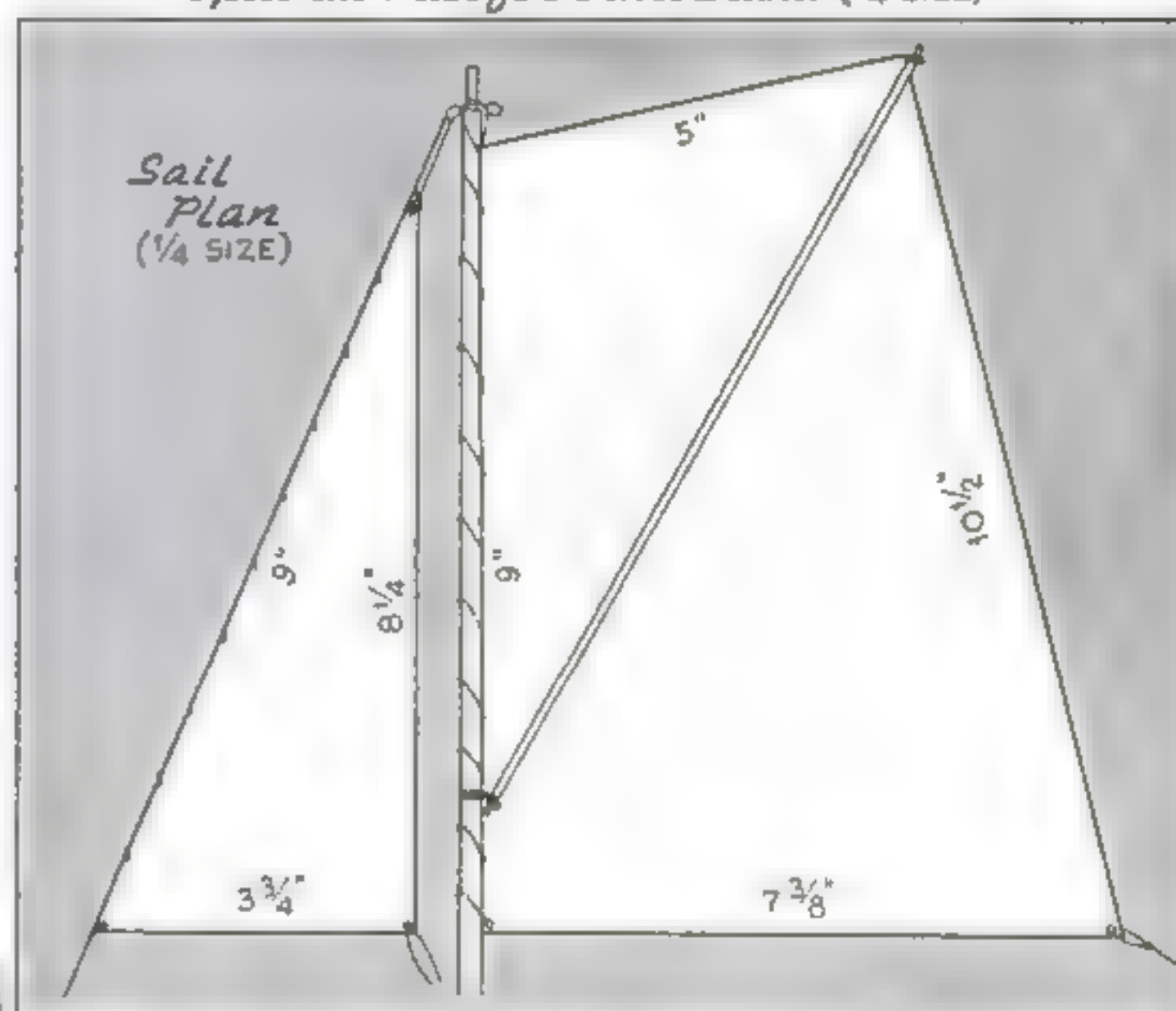
The model looks well if hung from davits. The drawings at the right are exactly one-quarter actual size



Optional Plan for Davit Stand (1/4 SIZE)



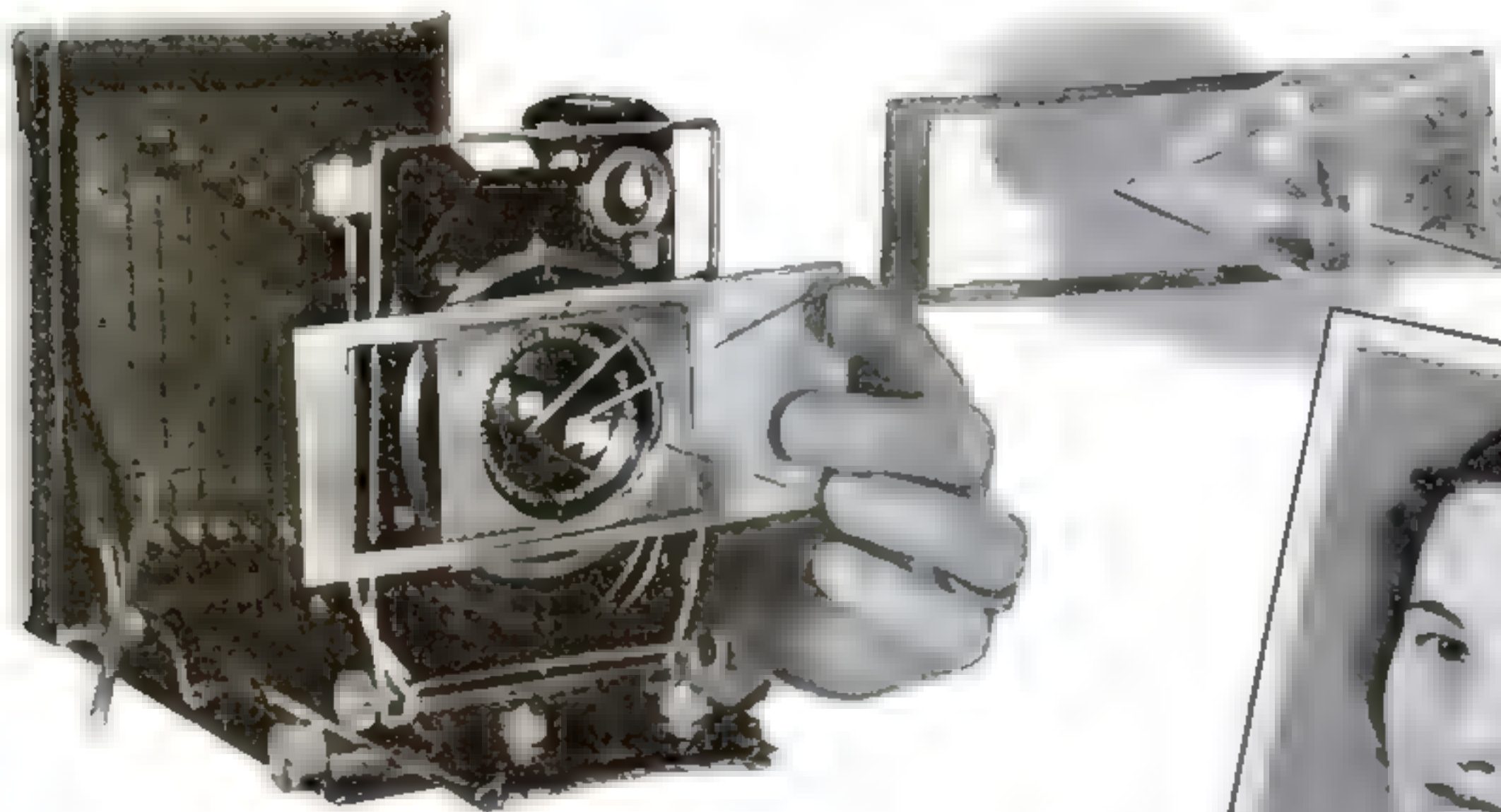
The waifs or flags, boat-hook, and other small parts above are shown half size



The quarter-size sail plan. An excellent way to display the boat is with the sail rigged and rudder shipped as shown in the first article (P.S.M., Sept. '37, p. 104)

Photo Accessories

ANY AMATEUR CAN MAKE



Glass Diffusion Attachment Gives Soft and Artistic Photos

EFFECTS rivaling those of a costly soft-focus lens may be obtained with this simple homemade diffusing accessory. When used on the camera, it softens all high lights and gives an artistic, professional looking brilliance. It has the advantage in portraiture of obviating considerable retouching. Even in the case of landscape photography, it sometimes lends a pleasing atmosphere.

If it is used while enlarging, instead of on the camera, it diffuses by spreading the shaded or darker portions of the picture and also minimizes any harsh, objectional grain.

Obtain a piece of fairly stiff alumi-

num or copper 2 in. wide—a width that fits the more or less standard filter holder—and about 5 or 6 in. long. Cut out a rectangular opening equal to twice the diameter of the lens in length and one diameter in width, starting $\frac{1}{2}$ in. from one end as shown. Next cut a wedge of common window glass and cement it to the metal frame in such a manner as to project halfway across the opening.

The extent of the diffusion depends on how far the wedge projects into the lens aperture. Users of miniature

cameras will probably find one ply of wedge sufficient; larger cameras, however, can stand a little more diffusion since the final print will not be enlarged proportionally as much. For this purpose an extra wedge is cemented over the first, but it is cut slightly smaller and stepped back, as shown.

When used while enlarging, the device is particularly convenient because the degree of diffusion is variable; and once adjusted, it may be left in place during the entire exposure.—R. O. L.

At left, a sharp print. Above, a much more artistic effect gained by using the diffuser in taking the picture and making the enlargement

cameras will probably find one ply of wedge sufficient; larger cameras, however, can stand a

Simply Made, Efficient Reflectors for Use with Photo Lamps

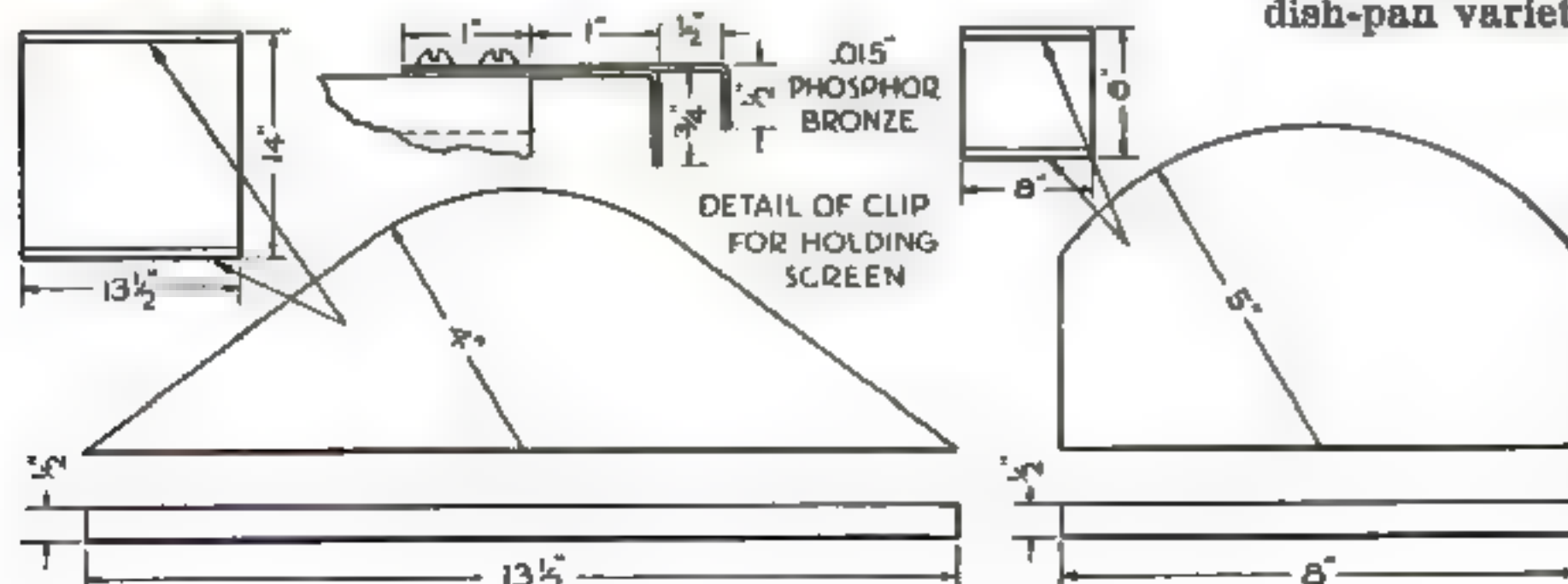


SUITABLE reflectors are important for indoor photography. They must reflect as much light as possible from the lamp and control its direction. Those illustrated are of an efficient type and not to be compared with the dish-pan variety. The

basic design is flexible enough to permit the reflector to be made for concentrated or flood lighting and for large or small photoflood or photoflash lamps. A diffusion screen may be attached very easily.

The main reflecting surface in each case is sheet aluminum 0.01 in. thick. It is nailed to the edges of the top and bottom, which are made of $\frac{1}{2}$ -in. seasoned wood and faced with the same gauge aluminum, held in place by short, flatheaded nails. Before this is done, the bottom should be drilled for mounting a porcelain socket. Photofloods Nos. 1 and 2 take medium screw sockets, while the larger No. 4 requires a mogul-type socket.

(Continued on page 124)



Portrait reflectors for No. 1 photoflood lamps. Notice how the diffusion screen is applied. Two basic shapes for the wooden members are shown

America's fastest growing hobby

SNAPSHOTS at NIGHT



Just do this

1. Load your camera with Kodak "SS" Film



2. Use two or three Photoflood lamps in Kodak Handy Reflectors



IT'S SNAPSHOT TIME in the American home, and fun is the order of the evening. Little sister poses in her crib... the older children at their games... the grown-ups around the fireside... and the family camera clicks busily away, recording the important side of life that is lived after dark—indoors.

You don't need an expensive camera for snapshots indoors at

night—not any more. Any camera that can be loaded with Kodak "SS" Film will do the trick—even the simplest Brownie.

With "SS" Film, use two or three of the new No. 2 Mazda Photoflood lamps, which last for hours, in the inexpensive Kodak Handy Reflectors. If your camera has an $f.6.3$ or faster lens, then No. 1 Photoflood lamps are powerful enough.



FREE BOOKLET.... Suggests a variety of picture opportunities, shows you how to arrange your lights, how to place your subject, tells you everything you need to know about two ways to make night pictures—snapshots with Photoflood lamps, *fast exposures* with Photoflash lamps. (You can use Photoflash lamps, each good for one picture, if your particular camera can be set for "time.")

The directions are simple and easy to understand; pictures and diagrams help make everything clear. Be sure to get a free copy at your dealer's today... Eastman Kodak Company, Rochester, N. Y.

NOW IF AN UP-SET STOMACH, COLD OR HEAD-ACHE COMES OUR WAY

WE JUST TAKE ALKA-SELTZER -- ARE WE THANKFUL? I SHOULD SAY.



An Alka-Seltzer Tablet in a glass of water makes a sparkling pleasant-tasting solution. Drink it and it gives quick relief from Headaches, Sour Stomach, Distress after meals and other common ailments. It also helps correct the cause of the trouble when associated with an excess acid condition.

COMPARED TO WHAT WE HAVE TODAY, THEIR BLESSINGS WERE BUT FEW

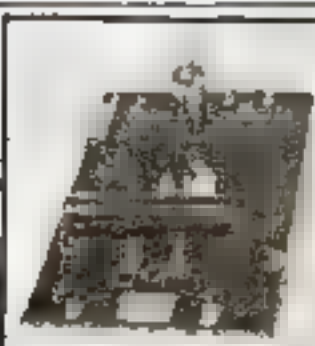
YET, FILLED WITH THANKFULNESS WERE THEY--AND SO OUR COUNTRY GREW



Woodworker's Turning and Joining MANUAL

The simplest, most practical ways to make end tables, chairs, benches, high-boys, book-racks, cabinets, all kinds of furniture in your spare time. A revelation of simplicity and helpfulness. Many illustrations. Full cloth bound \$1.00.

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Produced in Cinecolor by Carlisle & Fairbanks with the co-operation of the editors of Popular Science Monthly.

A Paramount Picture



Handy Man's Schedule for NOVEMBER

HERE are ten shipshape home ideas for November that will aid in making your home more modern and livable:

- Remodel mantel or fireplace front.
- Inspect heating plant.
- Install modern concealed radiators.
- Enlarge cellar windows to obtain more light.
- Paint kitchen or breakfast-room furniture.
- Install storm sash and repair where necessary.
- Provide humidifiers for air conditioning.
- Build railing for use on outside steps during winter weather.
- Clean gutters and drains, clearing out all leaves and rubbish.
- Build double windows for garage. Seal all chinks with felt or other suitable calking.

Our Whaleboat Model

(Continued from page 115)

in, block strapped to the masthead, and has one sheet. One end of the sprit is set in the strap on the mast, the other in the eye at the peak. The foresail, or jib, hauls up with a similar halyard on hanks (rings) on a stay, spliced to the masthead; it has a double sheet, going through the eyes strapped to the gun-wales.

When stowing the boat, I found the sails very bulky if wrapped around the mast, so I unbent them and stowed them in the bottom of the boat.

This model does not need any base-board or mounting, but if one is desired,

Materials for Davit Mounting

- Base— $\frac{5}{8}$ " x 3" x 14"
- Davits— $\frac{5}{8}$ " x 3" x 6"
- Posts— $\frac{1}{4}$ " x $\frac{1}{4}$ " x 7 $\frac{1}{2}$ "
- Brackets— $\frac{1}{8}$ " x 5 $\frac{1}{32}$ " x 12"
- Wire for davit supports, No. 22, brass, 8"; for block straps, No. 22, soft, 3".
- Double blocks: $\frac{3}{8}$ ", 2.
- No. 0 screws, 4; No. 0 screw eyes, 8.
- Cord—use left-over pieces from the whaleboat.

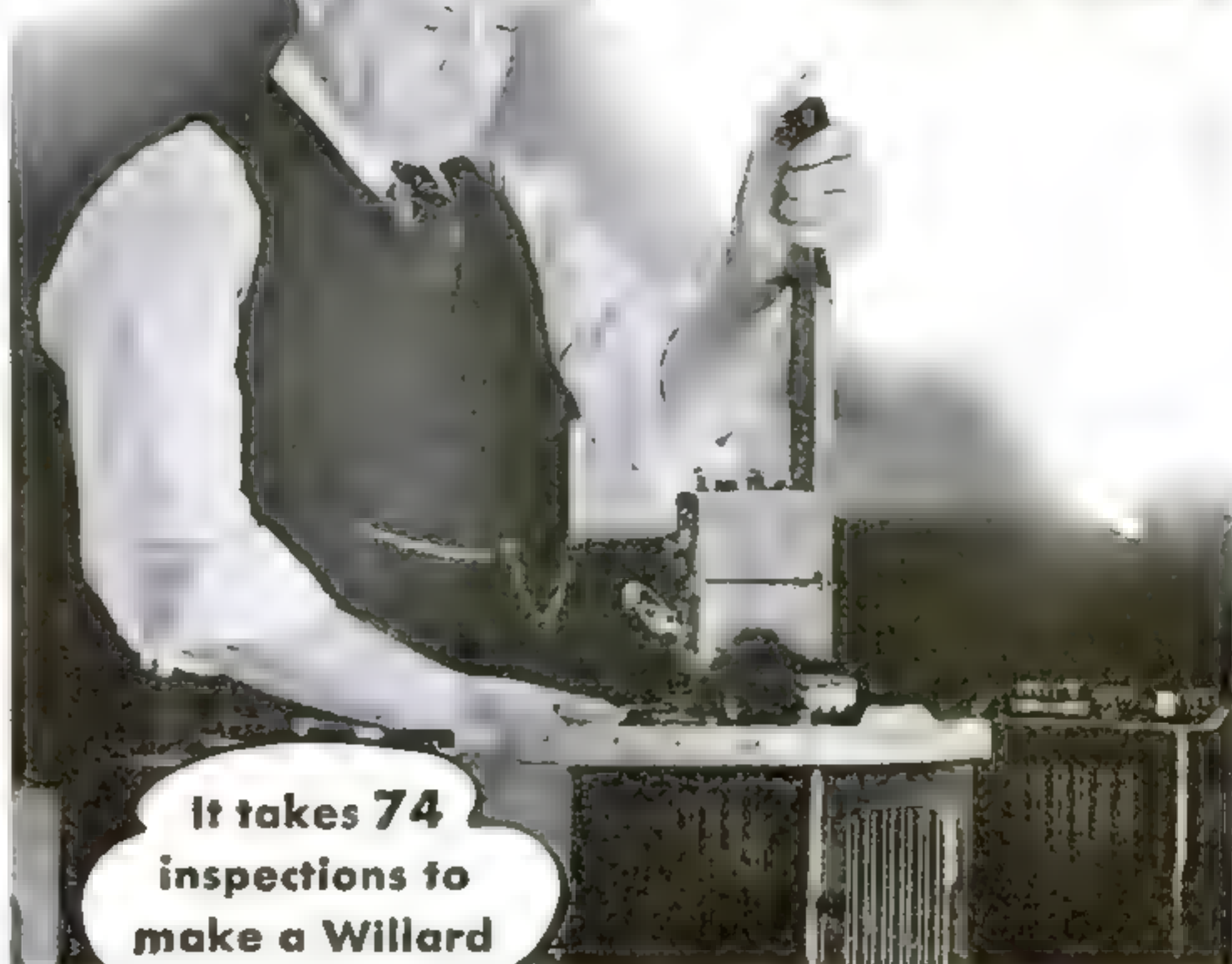
an excellent way is to hang the boat in a pair of whale-ship davits, as they would appear above the top of the bulwarks. A list of materials is given for this optional type of mounting.

Any size or thickness of baseboard may be used. I had a piece of five-ply walnut, and I jig-sawed the davits from the same wood. They are square in section and have three real, or imitation, sheaves in the ends, and cleats on the left side. I set them into the baseboard at the back and gave them wire steady-ing rods on the outside. Inside of them are a pair of posts to which are hinged gatelike supports for the keel of the boat. Lanyards run from the top of the posts to frap (bind) the boat in; these I brought down to eyes in the baseboard.

Two $\frac{3}{4}$ -in. iron-strapped double blocks complete the davit falls tackles; they have eyes for the ends of the falls above and hooks below to engage the eyes in the boat. Put the boat on the brackets, pass the lashings, steady tight the falls, belay to the cleats, and coil up some line.

Our little model is now finished—a picturesque symbol of old whaling days.

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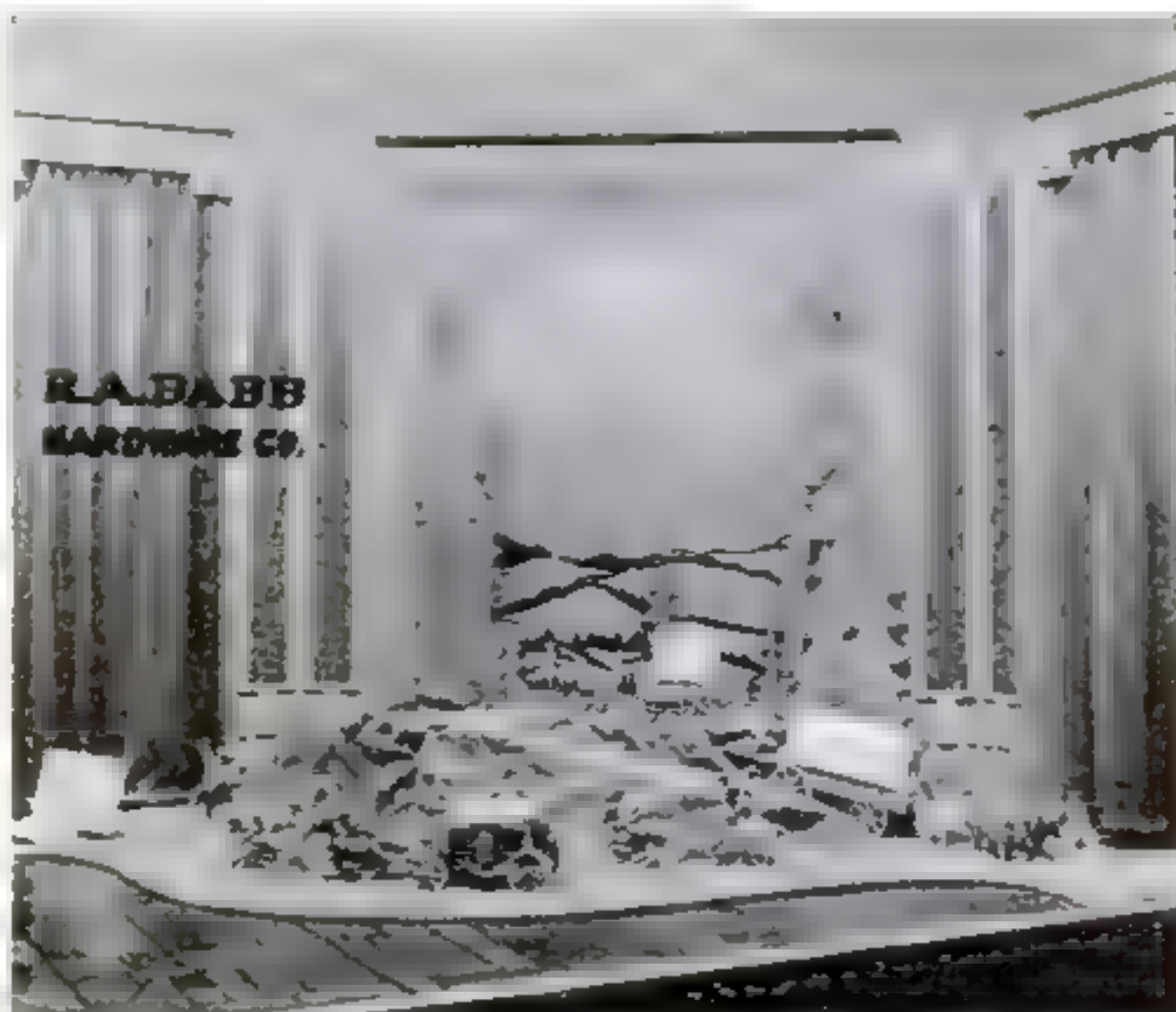


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**FIT GEM AND
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"Oregon Trail" exhibit displayed in a Eugene, Ore., store window. The carvings are by Mrs. Laura Koepp, whose photograph appears at right



Official Magazine
POPULAR SCIENCE
MONTHLY



Homeworkshop Guild Club Honors Woman Whittler

AS A TRIBUTE to her craftsmanship, Mrs. Laura Koepp has been made an honorary member of the Eugene (Ore.) Craftsman Guild, which is a club affiliated with the National Homeworkshop Guild. Although seventy years old, Mrs. Koepp finds pleasure in whittling as a hobby. She carved all the models in the display pictured above with an ordinary pocketknife in approximately six months.

The exhibit was shown in a hardware-store window in connection with a local Oregon Trail pageant. W. W. Cummins, a member of the Eugene club, made the background and arranged the setting.

Outdoor projects were constructed by members of the North Shore Craftsman Club of Waukegan, Ill., which met weekly throughout the summer. Plans have been formulated for an active winter season, and members are now working on furniture, ship and train models, and scroll-saw articles.

Another club that met regularly during the summer was the Cartier Homeworkshop Club, Montreal, P.Q., Canada. Six new members have joined. Jean Tremblay has started work on a model of the clipper ship *Sovereign of the Seas*, using POPULAR SCIENCE MONTHLY blueprints. George Frenette made a model of the famous German warship *Emden*,



Members of the Racine (Wisc.) Homeworkshop Club in the completely equipped shop of Carl Jensen. Note how neatly the tools and supplies are arranged in racks and on shelves

and Paul Denis has completed a model of a merchant boat, the *Cochrane*.

Officers of the newly organized Bay Homeworkshop Guild of *Baldwin County, Ala.*, are R. H. Boettcher, president; William Wilks, Jr., vice president and treasurer; Dave Wallin, secretary. The club will exhibit at the Silverhill and the Mobile fairs.

Reorganized recently, the *Springfield (Mass.)* Homcraft Club plans to divide its activities into three groups—boat building, wood carving, and cabinetwork. Officers are G. M. Kern, president; Joseph Morin, vice president; O. C. Stein, secretary; Walter Les, treasurer.

The *Nampa (Idaho)* Homcraft Club will hold an exhibit in conjunction with the local Junior Chamber of Commerce hobby exhibition during the Harvest Festival. L. A. Wirth, club secretary, has been made instructor in woodworking for the adult education class.

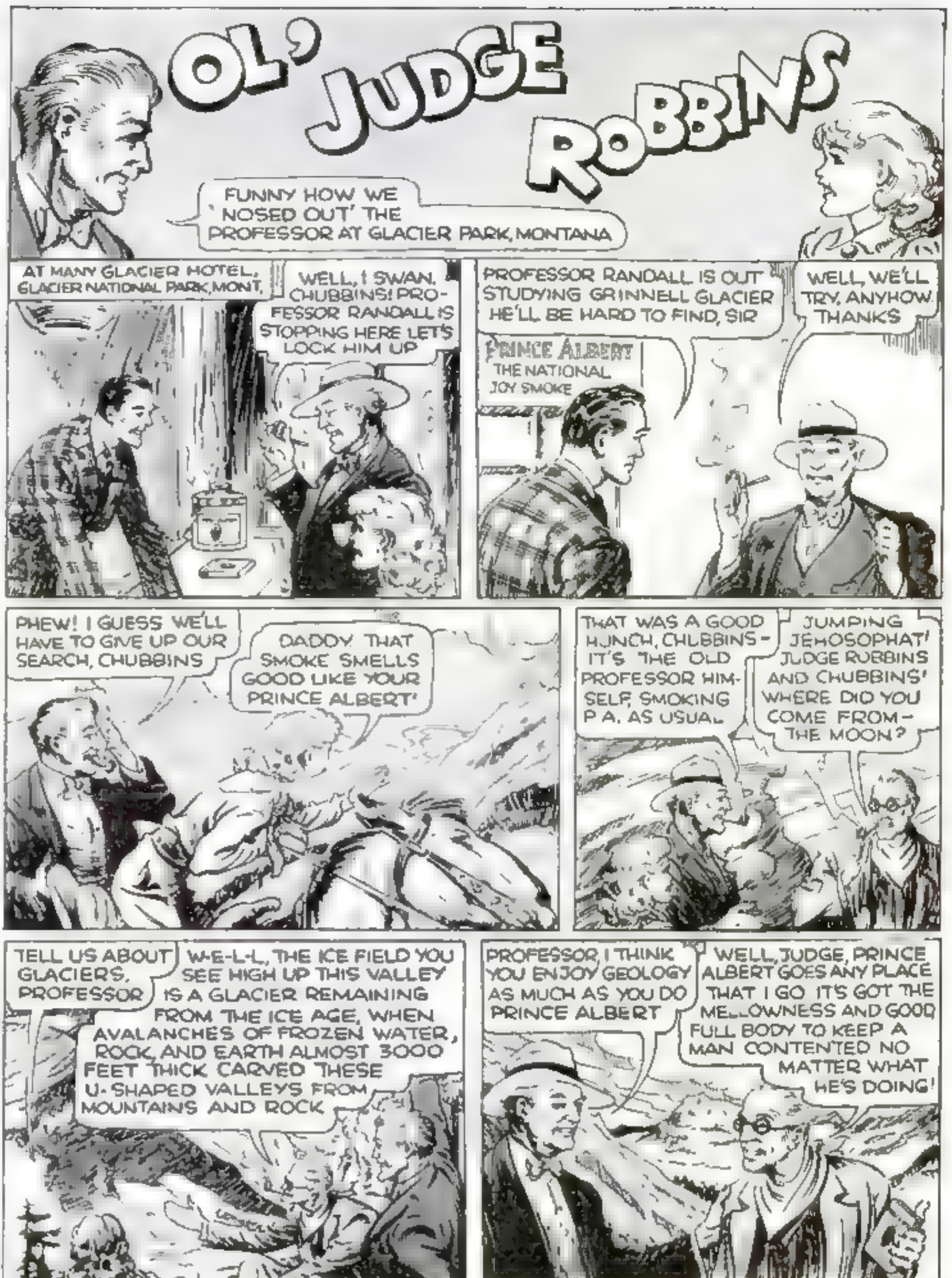
Stewart A. DeJong has been elected president of the Roseland Homcraft and Hobby Club of *Chicago, Ill.* Harry Isherwood is vice president and John W. Hough, secretary-treasurer.

Mark Waldo Page, of the *Pittsfield (Me.)* Craftsmen's Homeworkshop Club, has been awarded the junior state first prize in the Fisher Body Craftsman's Guild competition. The entry consisted of a model car designed by himself. He will use the prize, which amounted to \$100, to continue his schooling. William T. Russell, secretary of the club, reported, "The club feels greatly honored in having one of its members win in a competition of such importance and magnitude. We feel his efforts show the benefits of belonging to a club where one can find an outlet for his hobby."

The Capital Homcraft Club of *Washington, D.C.*, opened its fall activities with a discussion of shop practices.



Wood inlay pictures made by W. E. Mitchell of the Spokane (Wash.) Homcrafters. They depict Mt. Baker and "a home in the glen"



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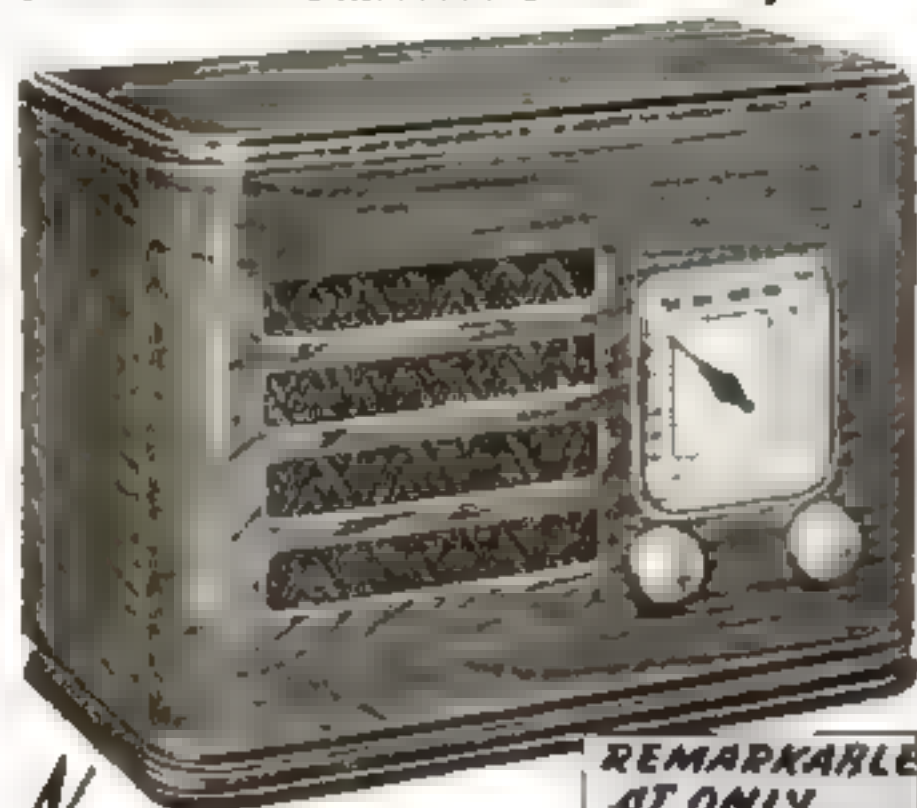
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Our blueprints have been prepared by experts and are available at a nominal price. The following subjects are a selection from the complete list, a copy of which will be sent to any reader upon receipt of a self-addressed, stamped envelope.



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(Continued on page 123)



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Old English CEMENTS

Workshop Blueprints

(Continued from page 122)

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Mayflower (24 in.), 83-84-85-R.....	1.00
New Bedford Whaleboat (14-in.), 326.....	.25
Normandie (20½-in. hull), 264-265.....	.50
Privateer Swallow, Baltimore clipper, (13-in. hull), 228-229-230-R.....	1.00
Racing Yacht Seascout (42-in.), 106-107-R.....	.75
Roman Galley (19-in.), 138-139-R.....	.75
Ship Model Weather Vane, 66.....	.25
Show Boat (14-in.), 263.....	.25
Sovereign of the Seas, clipper ship (20½-in. hull), 51-52-53-R.....	1.00
Spanish Treasure Galleon (24 in.), 46-47.....	.50
Stagecoach with Horses, 144-145-146-R.....	1.00
Trading Schooner (17½-in. hull), 252-253.....	.50
U. S. Battleship Texas (3-ft. hull), 197-198-199-200.....	1.00
U. S. Destroyer Preston (3¼-in.), 125-126-127-R.....	1.00
Viking Ship (20½-in.), 61-62-R.....	.75
Whaling Ship Wanderer (20½-in. hull), 151-152-153-154.....	1.00
Yacht Rainbow (7½-in. hull), 233.....	.25

(Construction kits are available for some of these models. See page 24.)



BOATS

Canoe, 16-ft. Canvas-Covered Kayak, with sail, etc., 192-193-194-R.....	1.00
Folding Duck Boat (13 ft. long), 170-R.....	.50
High-Speed Boat for Small Outboard Motors (7 ft. 11 in. long), 257-R.....	.50
Outboard Racer for Class "A" and "B" Motors, (10 ft. 4 in. long), 211-212-R.....	.75
Racing Runabout (13 ft. long, for outboard motor), 261-262-R.....	.75
Racing Sailboat Blackcat (13 ft. 4 in. long, 5 ft. beam, weighs 250 lb., Marconi rigged), 321-322-323-R.....	1.00
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Sport Runabout (9 ft. 8 in. long, 43-in. beam, for small outboard motors), 309-310-R.....	.75
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All-Wave Portable Receiver (two tubes, operated by battery), 217-R.....	.50
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Popular Science Monthly
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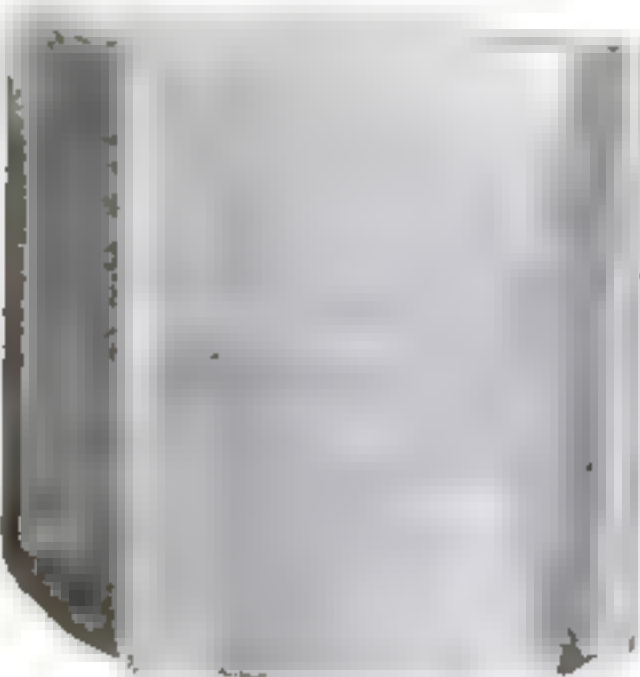
Simply Made, Efficient Reflectors

(Continued from page 116)



Parabolic reflector for flood lighting or group portraits, with small type diffuser

Below, large flood-lighting reflector for No. 4 lamps, reinforced in back with wood



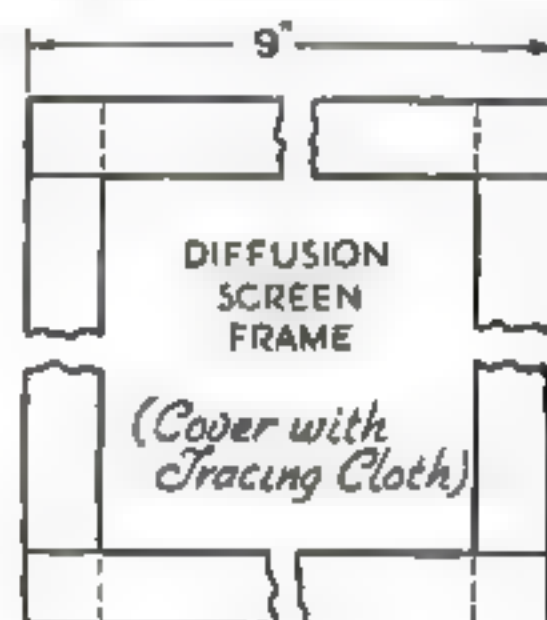
screen and attaching clips is shown in the drawings.

The outside of the reflectors is painted dull black, and the reflecting surfaces are coated with aluminum paint. A good reflecting surface is made by "graining" the aluminum (before cutting it up) with emery powder and a light oil. Under no circumstances should white enamels or paints be used, because they discolor quickly and turn brown from the heat of the lamp.

Several of these reflectors may be made for the price of one standard commercial article.—A. H. HONEST.

The shape of the wooden parts, which are best cut on a band saw, will determine the shape of the reflector; whether it is to be shallow or deep, whether the curve is to be circular or parabolic, and whether or not sides are wanted. Small reflectors for portrait work require no reinforcing. Larger ones, intended for flood lighting with a No. 4 photoflood, should be reinforced by a few ½ by ½-in. sticks of seasoned wood nailed to the top and bottom.

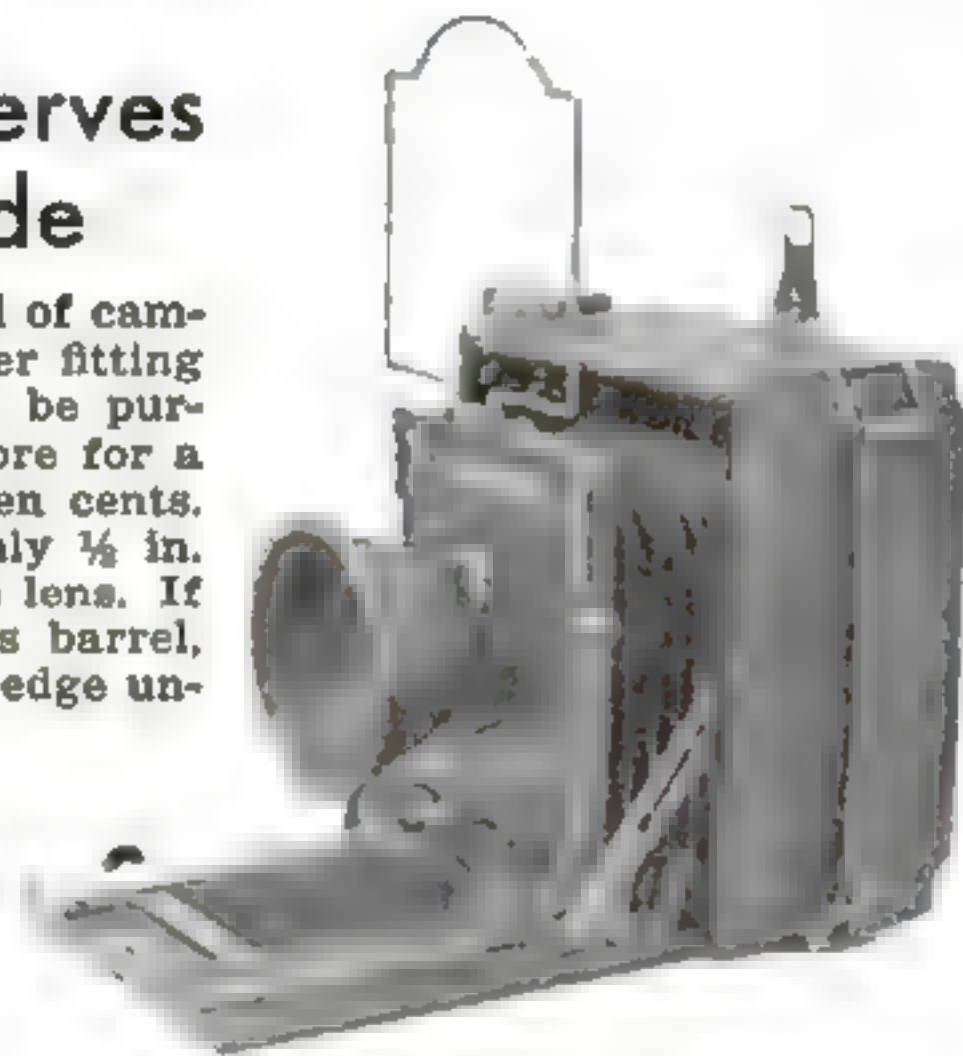
A method for making a diffusion



Gear-Shift Boot Serves as Lens Sunshade

AN EXCELLENT sunshade for any kind of camera can be made from a flexible rubber fitting known as a "gear-shift boot," which can be purchased at almost any auto accessories store for a trifling amount—usually not more than ten cents.

By cutting the smaller end, which is only ½ in. wide, the boot can be made to fit any size lens. If the opening fits too loosely over the lens barrel, apply small strips of adhesive tape to the edge until it holds well.—MATTHEW F. GRIMALDI.



An Easy Way to File Small Negatives

SHEETS of letter paper, 8½ by 11 in., folded accordion fashion, form convenient separators for indexing and storing negatives made on 35-mm. film. A single sheet will hold three strips of film, each strip having five exposures.

A filing box made from ¼-in. plywood, 6 by 8½ by 2 in. inside measurements, with a hinged lid, will hold approximately 150 of these separators, or 2,250 exposures. By keeping the box filled with

separators, even though some are empty, enough pressure will be exerted to prevent the film from curling.

In order to select quickly a particular negative from the file, use black drawing ink to put a number on the end of each film strip, and a letter—A, B, C, D, and E—on the margin of the strip opposite each exposure. Paste a print from each exposure in a scrap book and identify by this file number. Thus, a print marked "298C" is from the middle exposure of strip 298, filed numerically.

The sketch shows how the front of each separator is ruled to furnish space in which to record data for each negative.—C. ELMER BLACK.



The strips of film, each containing five exposures, are placed between the folds, and the outside is indexed as at right

	298	299	300
A			
B			
C			
D			
E			

A Dummy Swordsman

(Continued from page 104)

figure, turn in a screw eye. With a piece of string, tie together the screw eye and the washer soldered to the spring. This keeps the movable foil in the proper position. If a change is desired, loosen or tighten the string.

Bend a rubber cable from an exerciser in half and tie a small loop in the doubled part with a piece of wire, the opening being just large enough for the movable foil to pass through. Snap the ends of the rubber cable to screw eyes, one on each shoulder of the figure.

Both foils are made from 3/16-in. round flexible steel rod, each 39 in. long. Solder a small washer to each rod 4 in. from one end.

The hand guards are made from aluminum gelatin dessert molds, 4 in. in diameter. Drill a small hole in the center

LIST OF MATERIALS

Plywood—1 pc. 17 by 62 in.
Wood, 3/4 in. thick—1 pc. 12 by 33 in.;
1 pc. 8 by 17 in.; 1 pc. 8 by 11 1/2 in.;
1 pc. 3 by 3 in.; 2 pc. 2 1/2 by 5 in.
2 small angle irons.
2 rubber exerciser cables.
1 spring 12 in. long.
8 small chair rubbers.
2 pc. 3/16-in. round steel rod, 39 in. long.
2 aluminum gelatin molds, 4 in. in diameter.
2 rubber tips for foils.
Screws, screw eyes, washers, a 2 by 1/4-in. bolt, shellac, finishing materials, etc.

of the molds and pass the rods through; then solder another washer to the shaft on the other side of the mold. This finishes the movable foil. Pass its short end through the small opening in the rubber cable and then through the end of the spring. The foil, now supported on a flexible mounting, will move in all directions, returning to the center when at rest.

The other foil requires a handle. Cut from a 3/4-in. dowel or other round wood a piece 8 in. long. Drill a 3/16-in. hole 4 in. long in this and insert the rod with its guard snugly up against the handle. Drill a small hole through handle and steel rod 3 in. above the guard, insert a nail and cut off both ends flush with the handle. Wind the handle with string and apply shellac. Two different colored strings may be used alternately, if desired.

This foil should balance just outside the hand guard. If it doesn't and the rod is heavier than the handle, drill a hole through the length of the handle and pour in enough melted lead to balance the foil.

Tip the foils with rubber. When they are not in use, they are slipped through screw eyes so as to hang on the figure.

Can Opener Widens Plaster Cracks Preparatory to Patching Them

For deepening and widening plaster cracks before patching them, I use a can opener of the type made for beer cans. It will also serve for other scraping or cutting purposes when one does not wish to use a good tool.—FRED WEAVER.

ACTUALLY SAVES

up to 40% of your motor's power formerly wasted by belts!

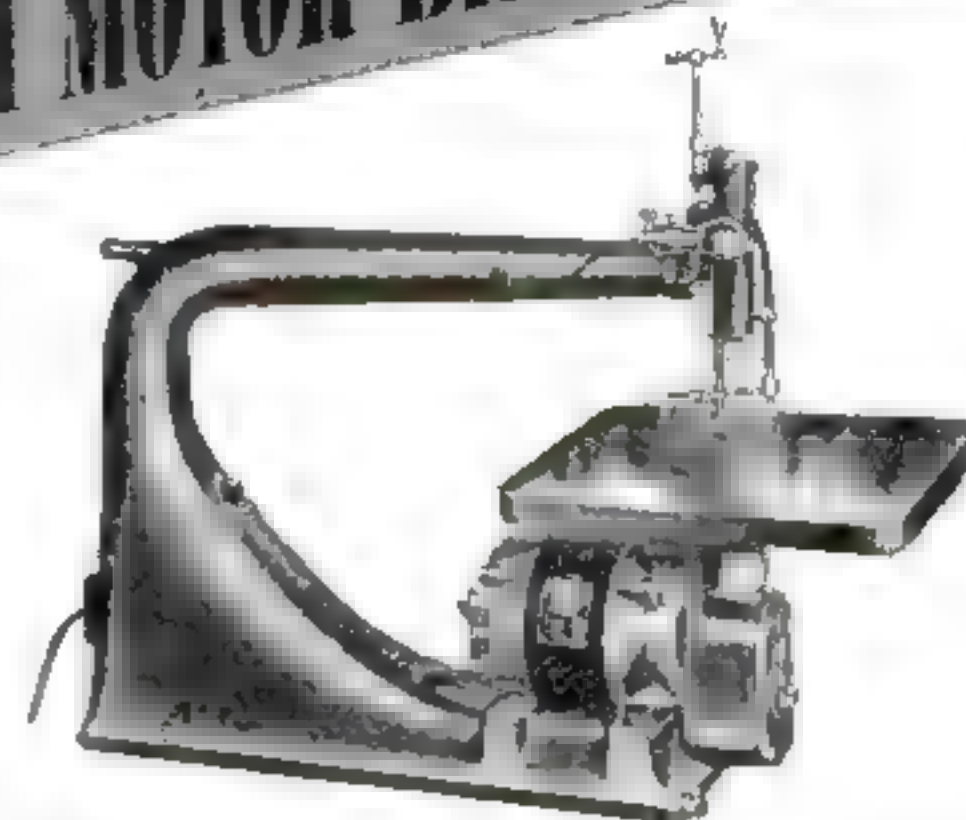


DRIVER MJ917 JIG SAW \$48⁵⁰

Complete with Motor (110 v. 60 cy.) lamp and bulb, extra outlet, cord and plug.

The MJ917 has a throat capacity of 24", a heavy 15" x 14" tilting table, splash oiling, removable arm for sabre sawing, fully adjustable blade roller guide and under-table blade support. An automatic blower keeps the cutting area clear of sawdust at all times.

MJ744—ONE SPEED DIRECT DRIVE MODEL
(otherwise similar to MJ917) as shown, less lamp and blade \$38⁵⁰



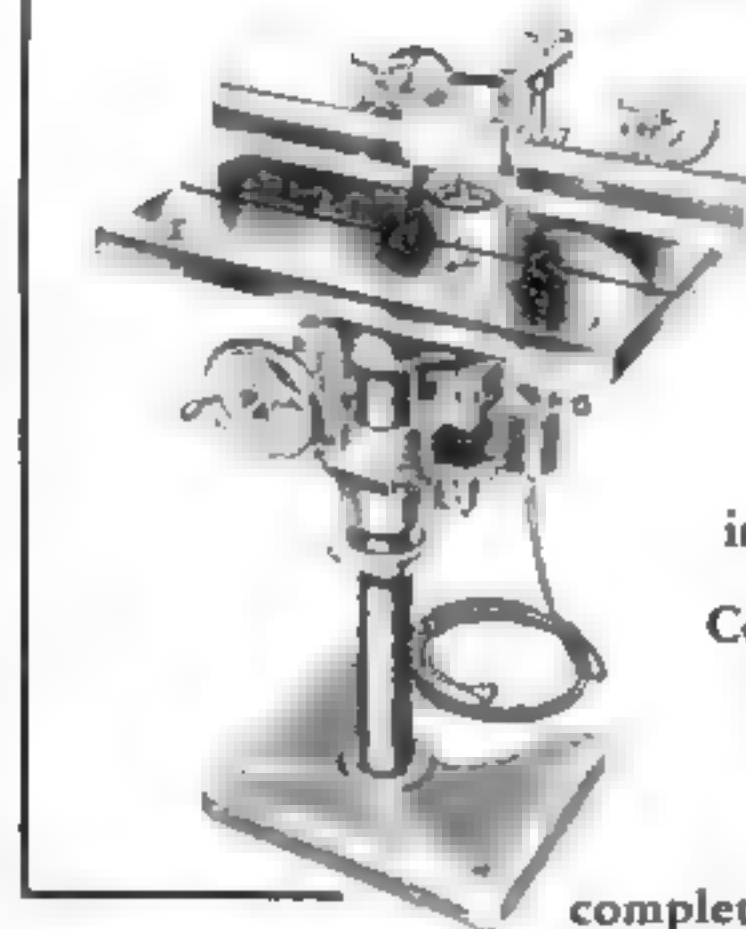
DIRECT MOTOR DRIVE—No belts, no slippage, no pulleys, no power loss! A simple, motor-to-blade driving mechanism as efficient and reliable as the crankshaft in your car.

"FINGERTIP" SPEED CONTROL—A simple flip of the switch changes the blade speed from low to high, while in motion. No stops for belt shifting. Handle any type of work without a stop!

"MOTION" BLADE TENSIONER—The most accurate way to adjust blade tension is while the saw is in motion. Driver makes it easy with the new type head and convenient adjusting handle.

DIRECT DRIVE

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S980 SHAPER (left)

\$125⁰⁰

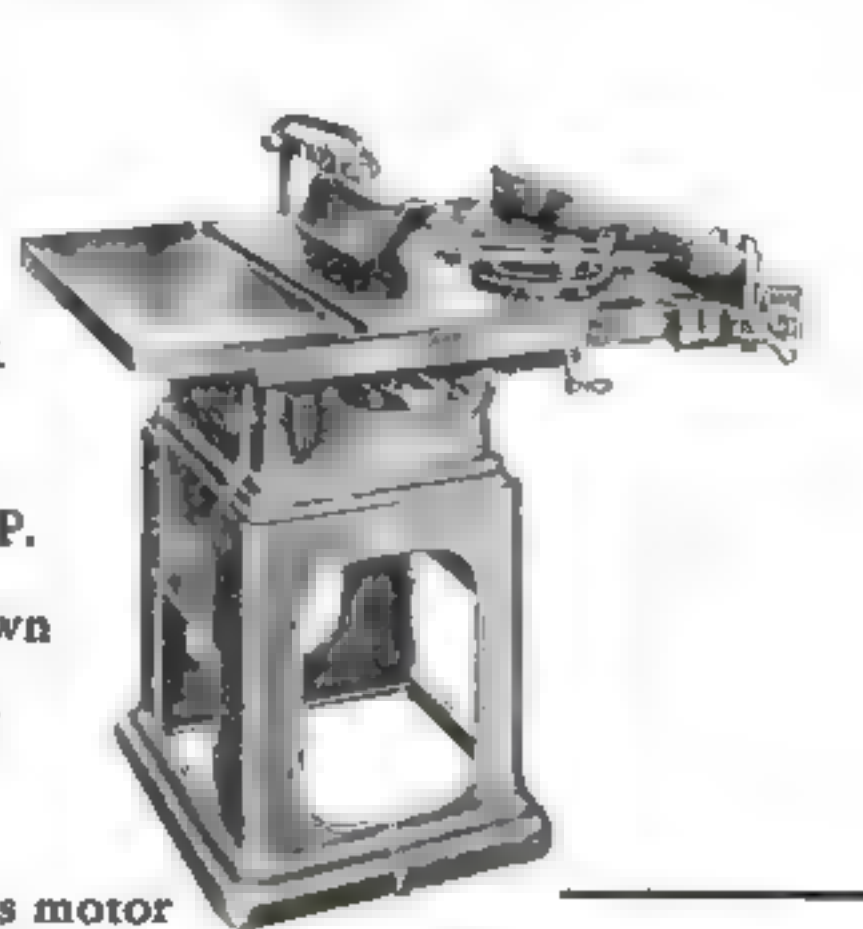
including 3/4 H. P. Motor

Complete as shown

990 TILTING ARBOR SAW (right)

\$75³⁰

complete as shown, less motor



S980 SHAPER . . . a new tool of intermediate capacity. Will do sanding, tenoning, dading, reeding, fluting, surface grinding, panel carving; taking over many jobs almost impossible by hand and giving your work a truly professional appearance. Big table, ball bearing spindle and motor, arbor control with 6" spindle movement and super-precision micrometer adjustment are a few of its many features.

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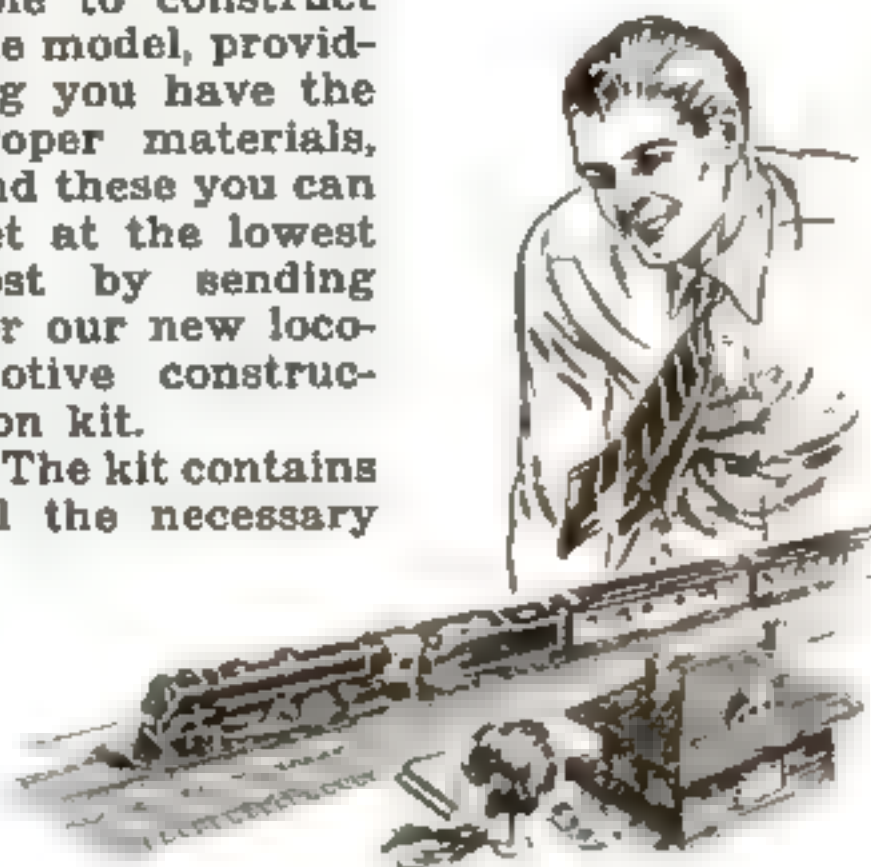
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Blades

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The kit contains all the necessary



From the materials in the kit you can make this type of electrically driven locomotive

sheet brass, brass tubes, rods, wire, springs, fiber, plain and shoulder screws, boiler head, ladder strip, and other materials. There are six finished driving wheels and axles, and ten pairs of wheels with axles for the trucks. Carefully detailed blueprints are, of course, included. The price is only \$9.95 postpaid (50 cents extra west of the Mississippi River and in Canada).

In addition to this kit, we are prepared to supply a specially built 6-volt electric motor of a very powerful but small type, designed to operate on four dry cells or a storage battery. A driving worm and gear of thirty-to-one ratio are furnished with the motor. This supplementary power unit costs \$4.50. If you order both kits at once, you will have everything you need to build an operating model, and you can install the gears and motor as you proceed with the construction.

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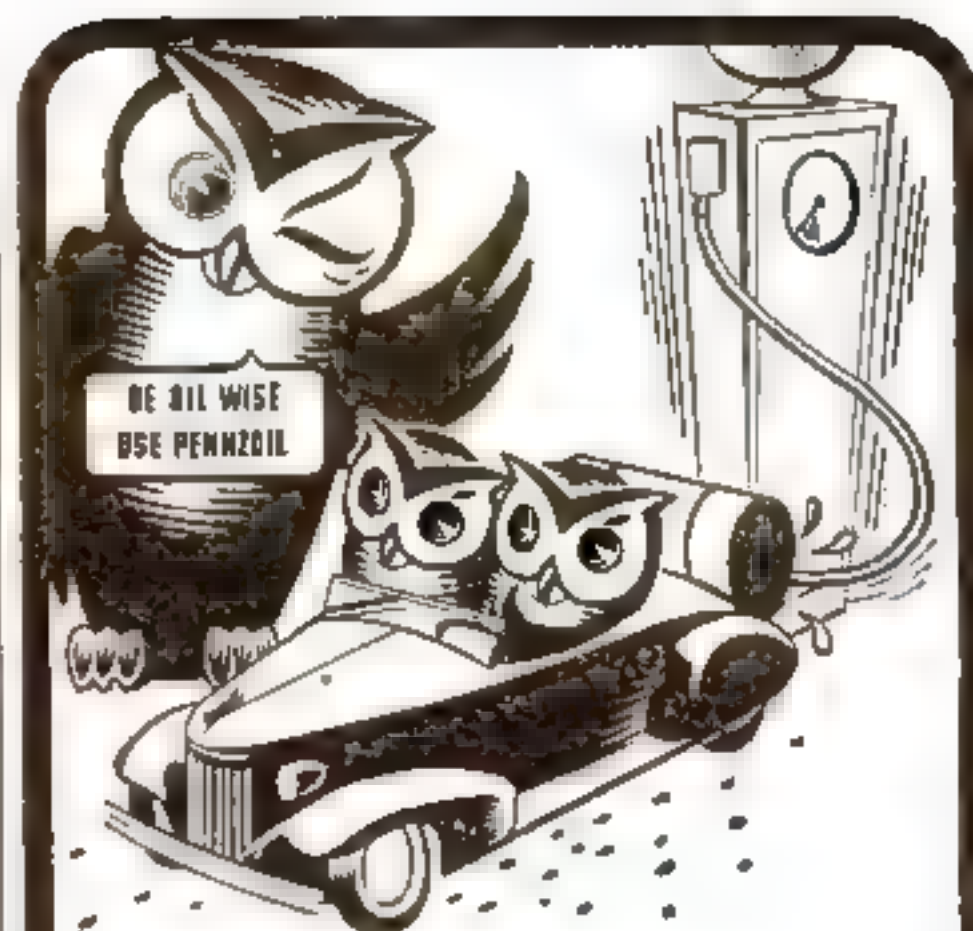
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Is often laggardly
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Better Signs Made by Using Jig-Sawed Letters

(Continued from page 92)

using a small straightedge as a guide, after which the last coat of enamel was brushed on the letters to cover and protect the screw heads. Great care was exercised to prevent brush spatters or drips from this work falling on the panel.

FOR the actual color scheme, although this cannot be shown in the illustrations, the entire background of the panel and the frame were painted light ivory, a more effective and attractive color than white. The cut-out letters spelling "Dwyers" were a medium sky blue, and the smaller letters were black, while the panel molding was standard Chinese red, as were also the poinsettias in the flowerpot. The latter form the central point of interest in the design and focus attention at this point, allowing easy eye movement to the items which are below.

Red could also have been used on the three urns at the top of the frame if more "flash" had been needed or desired. Remember that accent colors such as the Chinese red used here and the light but bright blue of "Dwyers" lose their effectiveness if a large amount is used. Too much color quickly becomes too little accent.

Such a sign as this is practical in that it can be kept in repair, washed clean at any time, and repainted at leisure during the winter months, or at any convenient opportunity.

Another type of design and color treatment, but one involving the same principles, had to be worked out for the orchestra stands illustrated. The name of the organization, "Crusaders," suggested the use of a heraldic shield with the name of the orchestra and the initials of the leader in a style appropriate to the whole concept.

Since the orchestra expected to move around considerably, the stands were made so that the music shelf let down when the two sides folded against the back face of the panel. The folded stands could then be packed in cases in sets of four. This would prevent them from being damaged in transit.

The panels were given a coat of enamel undercoater and two coats of ivory-colored four-hour eggshell enamel, which was chosen to avoid glare. To save time in painting the blue shields, several cardboard masks or stencils were made from chip-board stock, which was first given two coats of shellac as a sizing to prevent any absorption of the enamel.

SINCE it was necessary to keep each mask tight against the panel around the border line of the shield, masking tape was glued against the back of the chip-board stock, gummed side out, before the inner shield piece was cut out and discarded. Masking tape is a heavy, tough paper stock with a nondrying adhesive on one face. It is made from $\frac{1}{2}$ to 2 in. wide and is sold in 50-yd. rolls. This enables masking sheets, stencils, and the like to be fastened tightly in place and later pulled off without damage to the surface or finish. Such stencils can thus be used over again until worn out from handling.

The mask, prepared in this way, was applied to the panel, and the shield area was painted (Continued on page 128)



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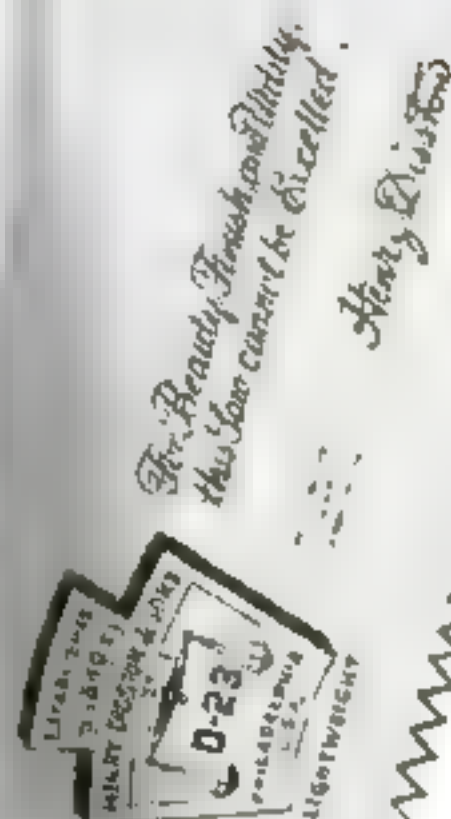
Better Smoking Tobacco



one of those
big he-man
size tins
proves it...
2 full ounces

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Name.....

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Better Signs Made by Using Jig-Sawed Letters

(Continued from page 127)

with one coat of blue enamel. This was allowed to dry hard before the mask was lifted off and used for the next panel.

The letters for "Crusaders" were jig-sawed from three-ply birch panel stock, sanded smooth on all parts, then given a coat of undercoater and one coat of white enamel on all edges, as were also the "L" and "F." All the raised letters were then glued and bradded to the panel after the "L" and "F" spaced had been gold-bronzed, dried, and outlined in a 1/4-in. wide black border.

NEXT the applied letters were hand-brushed with deep, rich blue on the "L" and "F," while "Crusaders" was coated with standard Chinese red to give the proper accent to the whole. The raised panel-molding border was coated in four-hour black enamel, and the folding back-frame panels were given a coat of flat black to make them invisible behind the footlights.

During one stage of the final color treatment, the faces of the letters all appeared in white against the azure-blue shield. This gave a dainty effect and would have been excellent for some other purpose, such as a sign for a girls' orchestra or a beauty shop. For the men's orchestra, however, more color was needed, so the Chinese red was added.

Protecting the Canvas on Boats and Kayaks

HERE is an easy yet durable method of finishing the canvas on canvas-covered boats and kayaks. First apply one coat of equal parts of boiled linseed oil and kerosene. Allow it to dry thoroughly, then use a putty knife to apply a coat of zinc ground in oil, filling all the pores and smoothing the surface. After this has dried, finish with two coats of color ground in oil.

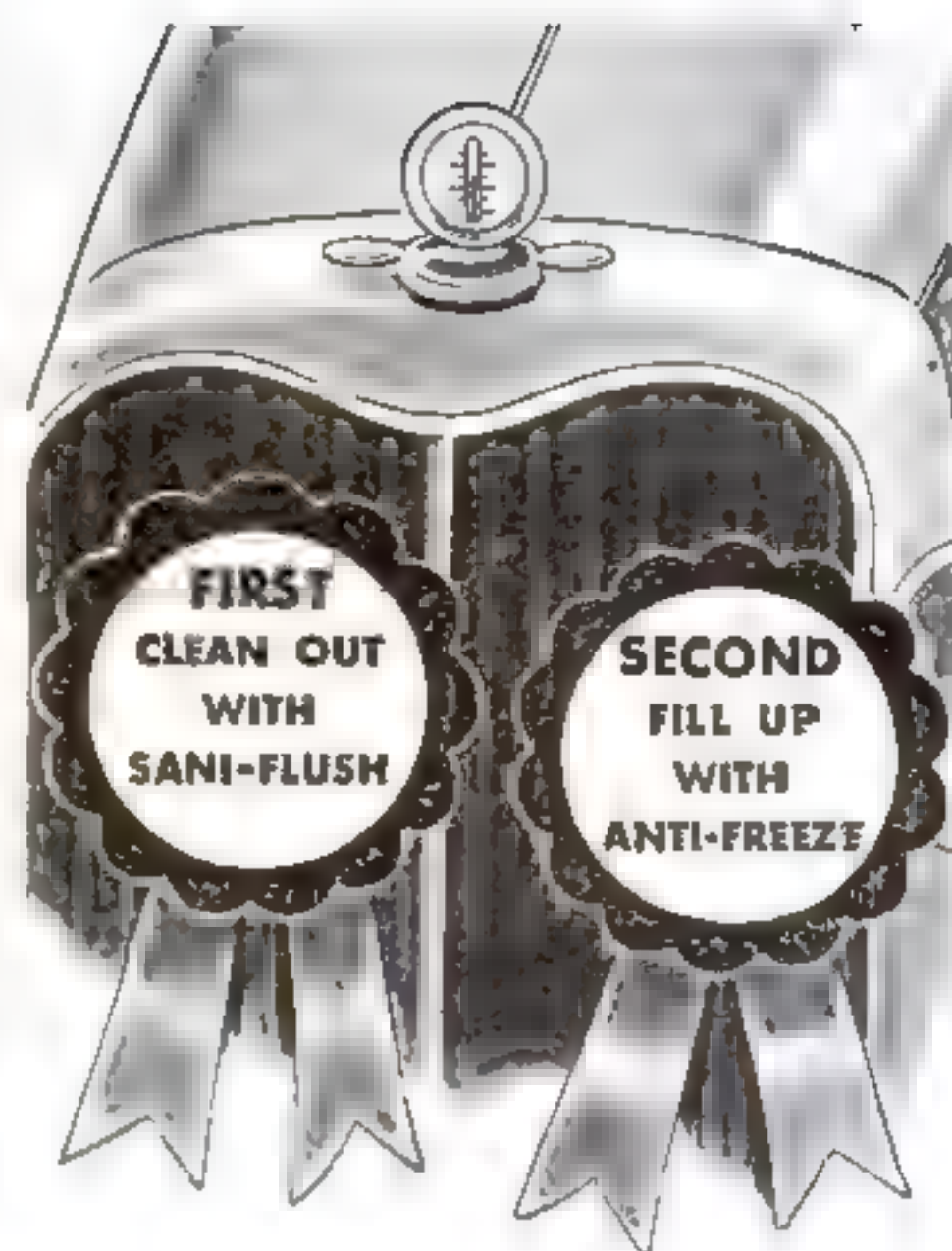
This finish does not make the canvas brittle, will not peel, and has given me satisfactory service for seven years. The canvas is pliable and tough, a combination that makes it resist puncture when coming in contact with snags and stones.—FRED H. SCHULTZ.

Vacuum Cleaner Keeps Workshop Dustless

BEING among those who dislike the task of cleaning up sawdust and shavings, I solved the problem by using an old vacuum cleaner and a long flexible rubber hose. By fastening the end of the hose near the machine in use and turning on the switch, a great deal of cleaning is eliminated. With various attachments, it is a simple matter to clean off the workbench, machinery, and odd corners.—GAIL M. FOSLER.

Old Tire Chain Cleans Soot from Long Stovepipes

LONG stovepipes to which elbows are riveted in such a way as to make it difficult to remove the soot, can be cleaned by sliding an old tire chain back and forth inside the pipe.—J. J. EDWARDS.



A WINNER FOR WINTER

DON'T waste anti-freeze by putting it in a dirty radiator. It heats up needlessly and boils away rapidly. Spend ten cents and very few minutes to clean the radiator thoroughly with Sani-Flush.

Just pour a little of this powder in the radiator. (Follow directions on the can.) Run the motor. Drain, flush and refill with clean water. That's all there is to it. Dangerous lime deposits are purged away. Rust and scale are banished. The delicate veins of the radiator flow freely. Sani-Flush cannot injure aluminum cylinder heads or motor fittings. Look for Sani-Flush in most bath-rooms for cleaning toilets. Sold by grocery, drug, hardware, and five-and-ten-cent stores—25 and 10 cent sizes. The Hygienic Products Company, Canton, Ohio.

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Silver Napkin Rings

(Continued from page 95)

the holder is made slightly convex across its width.

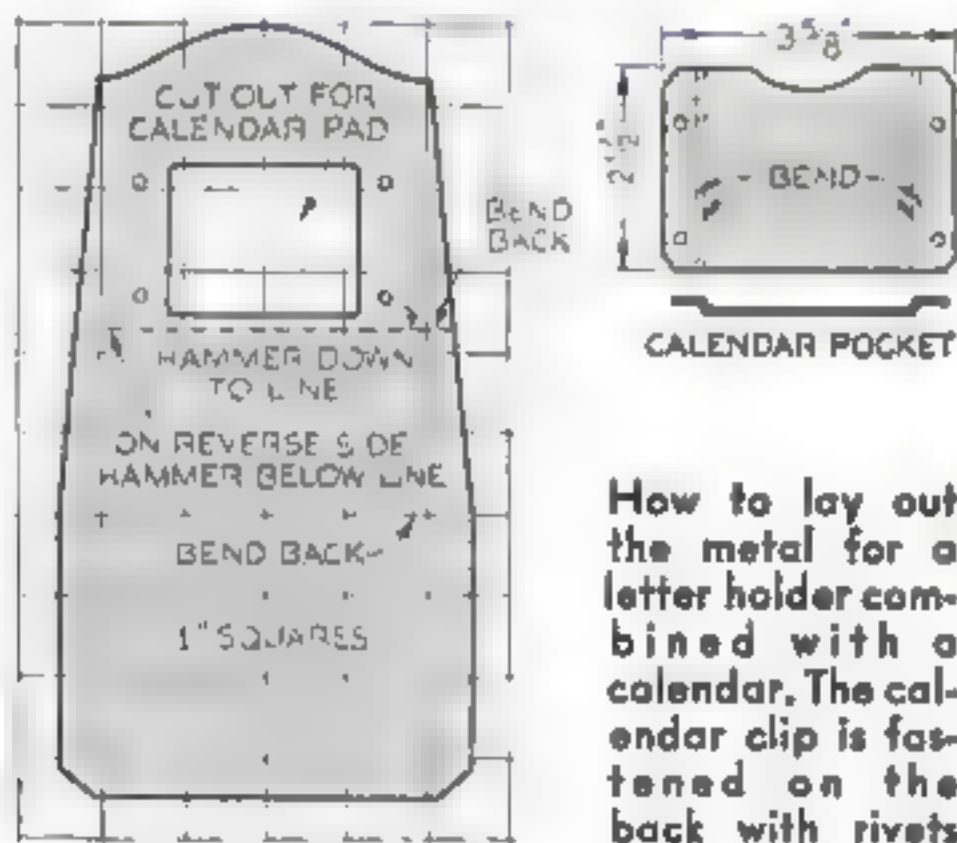
The next operation is to bend the holder to shape. This is done over a tool made from a piece of $\frac{3}{8}$ -in. steel rod and held in the vise. Not only is the metal bent in the center where marked, but also slightly at both ends, so as to bring the joint in the center of the bend. In the case of a rectangular napkin holder, however, the joint is made to come at a corner.

The ends of the work are held together by a binding of iron wire, and the joint is hard soldered. This is followed by pickling to remove the scale. Finally the piece is polished.

In general it will be found that almost all metals are easier to saw before being annealed, but it is essential that the work be annealed before bending and similar forming operations are attempted.—JOSEPH HAGANS.

Copper Letter Holders

(Continued from page 107)



How to lay out the metal for a letter holder combined with a calendar. The calendar clip is fastened on the back with rivets

the outside or face of the letter holder.

The piece for the other design is cut and hammered in the same manner. A section is cut out for the calendar pad, four holes are drilled for attaching the pocket, and the piece is bent to shape. The pocket is made from 24-gauge copper, bent to shape and riveted with brass escutcheon pins.

Dissolve a small piece of liver of sulphur in about 2 qt. of water and immerse the pieces until they turn brown. Remove, wash and dry, then polish and lacquer.

A calendar pad may be obtained at any large stationer's.—DICK HUTCHINSON.

Holes in Plaster Wall Filled by Using Cardboard Backing

WHEN it is necessary to patch a hole in plaster where the lath or other backing has been destroyed, take a piece of cardboard a little larger than the hole, force a wire through the center and bend the end to retain the cardboard, then bend the cardboard so that it can be pushed through the hole. Pull back on the wire and hold the cardboard firmly enough to form a backing for the plaster. Keep it in this position for a few minutes to allow the plaster to set, then clip off the wire and push the imbedded part back through the wall with a nail or another wire. In work around flues, use tin instead of cardboard.—M. G.

"THE FIRST STEP IN MAKING A SHIP MODEL... SHARPEN YOUR TOOLS"

Says HAROLD T. BODKIN, master craftsman and author of the syndicated newspaper feature "The Home Craftsman's Corner"

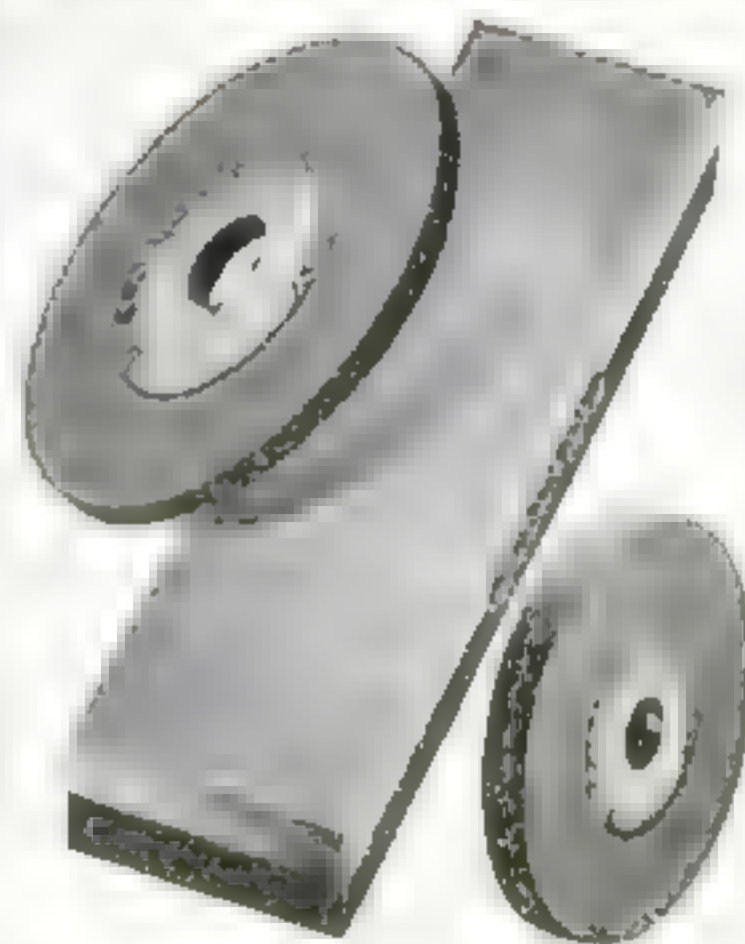


Illustrated above is "Sovereign of the Seas" designed and built by Mr. Bodkin.

GIVE YOUR TOOLS A SHARP KEEN EDGE WITH CARBORUNDUM BRAND ABRASIVES

Whether you're building a ship model or anything else, sharp tools will help you turn out a better piece of work. It's a real pleasure to work with sharp tools. A well-sharpened chisel, gouge, plane iron, auger bit or knife cuts cleaner, faster and more accurately. Give your craftsmanship a real chance with sharp tools.

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ABOVE—Carborundum Brand Silicon Carbide and Aloxite Brand Aluminum Oxide Grinding Wheels and Sharpening Stones for metal grinding and tool sharpening. Available in all standard sizes and grits.

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Mail coupon and 20c today for sample sharpening stone and useful handbook. Shows how to keep tools in condition.



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When certain families have a 14% better chance for success than others—it's worth looking into! Records show that families owning Royal Portables have a decided advantage in work, at school, at home. No typing experience is necessary—thanks to Royal's own features, it's easy for anyone to use.



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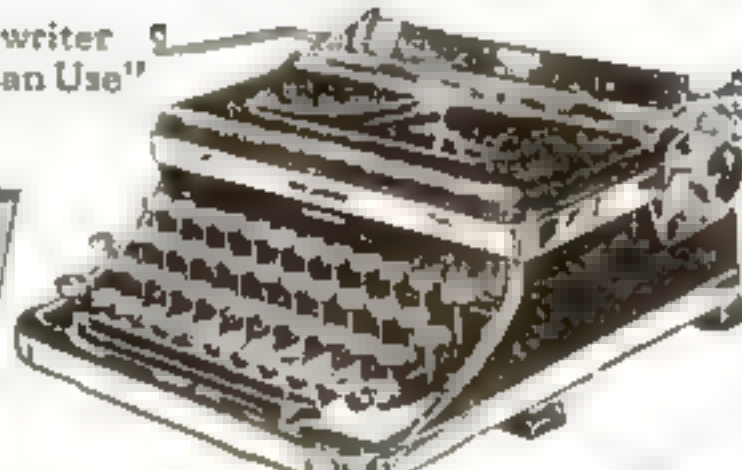
MOTHER will use it every day, for so many things; personal correspondence, club reports, household "business."



THE CHILDREN will get a new grip on their world. Tests in 11 cities have shown that typewriters raise grades remarkably—improve all the child's work and give him—or her—a better preparation for jobs later on.

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At all druggists . . 15, 30 and 50 cents

Last Stand of the Windjammers

(Continued from page 67)

Harbor, her sails furled and yards neatly squared. As the tug of the news men appeared, she tripped her anchor and stood out to sea under the power of her Diesel auxiliary engines. At ten o'clock a whistle blew for the performance to begin. In exactly twenty-six minutes, twenty-seven giant sails—28,500 square feet of canvas—were set and drawing.

The show, however, had merely begun. As the big ship slipped away, a buoy was thrown over her stern to simulate a man overboard. Immediately the alarm was sounded and the yards on the foremast were hauled aback to stop the motion of the vessel. A lifeboat quickly dropped over the side. As the ship lay hove-to, the boat crew rowed to the buoy, guided by signalmen on the crosstrees. Within twelve minutes, the boat was again in its davits, the "rescued" buoy on deck, and the ship once more on its way.

AN AMAZING feat of seamanship and dogged determination was exhibited aboard the *Herzogin Cecilie*, former prize training vessel of Germany. After the World War, Capt. Gustav Erikson, noted sailing ship owner of Finland, bought her for a mere \$20,000, to take her place as the crack ship of his Cape Horn grain fleet. Under Capt. Ruben de Cloux, a Swedish Finn, she set sail, in ballast, for Australia. Her crew was made up chiefly of boys in their teens, most of whom had never sailed in a deep-sea square-rigger before; some were apprentices who were paying for the experience.

In a raging gale, north of Scotland, the ballast suddenly shifted. The great *Herzogin Cecilie* fell on her beam ends, with the tips of her topgallant yards trailing in the sea. In danger of being carried to the bottom at any instant, Captain de Cloux and his boy crew set to work in an attempt to restow the ballast. Day and night they worked, exhausted and almost foodless, the Captain always leading. After four days of terror, the giant four-masted ship was once more on an even keel and sailing on her way.

Considered by many ship lovers as the finest square-rigger still on the seas, the *Herzogin Cecilie* met her end just last year, going aground off the Devon coast of England. A public appeal was made for funds to salvage her and restore her again to the grain trade, in which she had made history. Before sufficient funds could be obtained, however, a storm caught her and broke her back on the rocks.

To get a glimpse of the amazing modernness of one of the newest big sailing ships built especially for cadet training, let us inspect Brazil's *Almirante Saldanha* as she lies at anchor in the Hudson River at New York City, a port of call on one of her regular cruises.

AS WE first see her from the thwarts of the cutter that takes us to her side, her fine lines and spick-and-span trimness suggest a well-groomed yacht. She is as long as one and a half city blocks, and some fifty-odd feet wide. Her four tall masts are bare now, but plainly rigged for four square sails on the foremast, and schooner sails on the main, mizzen, and jigger. Twenty sails in all, the boatswain tells us, flaunting 27,000 square feet of canvas before the

wind. When fully manned, she carries twenty-five officers, 100 cadets, thirty-four warrant officers, and 300 seamen.

On this ship of an era which is practically past, we find gyro-compass and fathometer, radio direction finder, and powerful electric generating plants. With its hull divided by a maze of watertight bulkheads and double bottom, the vessel is practically unsinkable. Steam plants supply heat for chilly weather and power for capstans and winches. Distilling plants provide fresh water when the supply gives out. And should the wind fail completely, she carries oil enough in her fuel tanks to drive her 12,000 miles, at eleven knots, under the power of a 1,400-horsepower Diesel engine!

ELECTRICAL equipment such as generators, motors, and control gear, had to be especially designed to meet the ship's peculiar needs. One of the requirements was that all this equipment must operate satisfactorily when inclined fifteen degrees from level in any direction. This was to insure uninterrupted service when the ship rolled or pitched, or sailed for long periods heeled over on a single tack. Special bearings had to be devised to satisfy these conditions.

The United States Navy has given up deep-sea sail training, as consuming too much time that is needed for other studies. Periodically, efforts are made to revive it, some proponents suggesting that the U.S.S. *Constitution*, "Old Ironsides," be made the training vessel. Since her reconditioning, this historic frigate is in thoroughly seaworthy condition.

The United States Coast Guard also has given up sail training, but with greater reluctance. Its last training ship, the *Alexander Hamilton*, barkentine-rigged steamship, was retired several years ago, and Congress has thus far failed to appropriate funds to build a new one.

Cadets of two of the four state-operated merchant-marine academies in the United States, however, still learn the ways of the sea from the fo'c'sles, poops, and rigging of ocean sailers. Boys from Pennsylvania train on the schooner-rigged *Annapolis*; boys from Massachusetts, on the bark *Nantucket*. Both of these vessels are really steamships, former Navy gunboats fitted with auxiliary sails. Each spring they set out from the Philadelphia and Boston navy yards, respectively, heading generally for Europe or South America. They pride themselves on usually making at least half the voyage under canvas.

AS TO the practical value of sailing ship training, experts disagree. Critics say that the greater part of the knowledge gained under sail is useless, or even must be unlearned, when a cadet steps aboard a steamship. For instance, they point out, the steering of a sailing vessel is not done by compass, but by the feel of the wheel and the direction of the wind. The finest sailing-ship helmsman steers by an instinct that comes from long experience. No matter how expert he becomes, however, steering a compass course on a steamship, with a steering engine between wheel and rudder, is an entirely different matter requiring new training (Continued on page 131)

Windjammers' Last Stand

(Continued from page 130)

that must start right at the very bottom.

One of the last nations of the world to abandon auxiliary sails for her warships, Great Britain was the first great maritime power to give up sail training entirely for both her navy and merchant marine. Several attempts to revive it have been futile. She still owns a few beautiful sailing vessels, including the bark *Arethusa* and the schooner *Westward*, on which cadets are quartered and taught, but these are moored and probably will never again go to sea.

"The deep-sea sailing ship has disappeared" says the report of a special committee of the British Shipping Federation, in answer to criticism. "Her memory has been surrounded by glamour and romance, which has been the inspiration of a good deal of sentimental but not very practical talk. The boy who served two years' apprenticeship in sailing ships, beyond acquiring considerable agility aloft, would not develop any characteristic which he could not acquire in a steamship."

ONLY a few months ago, on the other hand, the Royal Canadian Navy decided to go back to sail for training its future officers. "It is fundamental that sailors should know how to sail," said one authority. "They should know how to work aloft, know what the wind and sea do to a ship; and these things cannot be learned in steam." To back up their conviction, they have just built a schooner for use as a school ship.

To Captain J. H. Tomb, U.S.N. (Ret.), Superintendent of the New York State Merchant Marine Academy, limited sail training, while not at all necessary in the technical education of a steamship officer, makes a wonderful proving ground. Take a group of boys for a three-months cruise on a sailing ship, he says, give them a taste of hauling sails and laying aloft in all kinds of weather, let them face some of the elemental furies of wind and sea, and the real sea-loving boys who may profitably study to be officers will prove themselves. The rest may go back to their desks or farms without further waste of time.

FORGETTING technical quibblings about the length of time needed in sail, or the relative abilities of men trained in sail and steam and of men trained in steam alone, both advocates and opponents of sail training agree without qualification upon this primary use of the sailing ship. The last sight of the windjammer for its life on the sea will therefore probably be still a long one.

Menus Painted on Roof Advertise Restaurant

LUNCHEON menus painted on the roof of a restaurant in New York City serve as a novel form of advertising designed to catch the eye of office workers in adjacent skyscrapers. Popular dishes are listed on the roof-top menu in letters from two to four feet high. The unique bill of fare is plainly visible from windows as far up as the fiftieth story of a towering office building in the next block.

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Home Workshop Bench

(Continued from page 109)

and-tenon construction could be used, but if lag screws and bolts are placed where indicated in the drawings and the remainder of the joints are securely nailed, the bench will be amply rigid.

The top may be made of 2 by 6-in. planks laid flat, but it is much better to use strips sawed about 2 in. wide and placed together, edge grain up. Holes are bored through these strips as shown for long $\frac{3}{4}$ -in. bolts or rods threaded at both ends. These holes must be the exact size of the rods so that the wooden strips will have to be driven into place.

After the top is assembled and the rods screwed up tight in the countersunk holes, the upper surface should be cross

LIST OF MATERIALS

No. Pc.	Description	T.	W.	L.
4	Legs	2	6	30
2	Top side rails	1	5	46
2	Top end rails	1	5	22
2	Bottom end rails	1 $\frac{3}{4}$	5	22
1	Spreader	1 $\frac{3}{4}$	5	43 $\frac{1}{2}$
13	Top members	1 $\frac{3}{4}$	1 $\frac{3}{4}$	48
2	Cleats for fastening top	2	2	17
4	Vise ways (oak)	$\frac{3}{4}$	1 $\frac{3}{4}$	15
8	Vise guides	$\frac{3}{4}$	$\frac{3}{4}$	15
2	Vise heads (hard maple)	1 $\frac{1}{2}$	4 $\frac{1}{2}$	12
2	Vise faceplates (maple)	$\frac{3}{4}$	4 $\frac{1}{2}$	12
1	Vise supports (4)	2	5	96
3	Bolts or threaded rods, nuts, and washers for top	$\frac{3}{4}$ dia.		22
2	Bench dogs			
2	Vise screws, complete			
8	Lag screws (minimum)	$\frac{3}{4}$ dia.		4
4	Draw bolts and washers (minimum)	$\frac{3}{4}$ dia.		6

Note: Additional lag screws, bolts, or nails will be required, depending upon the method of assembly used; also screws for attaching the top. All dimensions are given in inches. The wood is yellow pine except where otherwise noted. The price will vary to some extent with the locality, but in Miami, Fla., the complete list, including all hardware, is priced for delivery at \$10.04. Some expense may be saved by using lower grade stock, by providing only one vise, and by using a plain instead of a built-up top.

planed by hand to get it level and then smoothed by planing and scraping it from end to end.

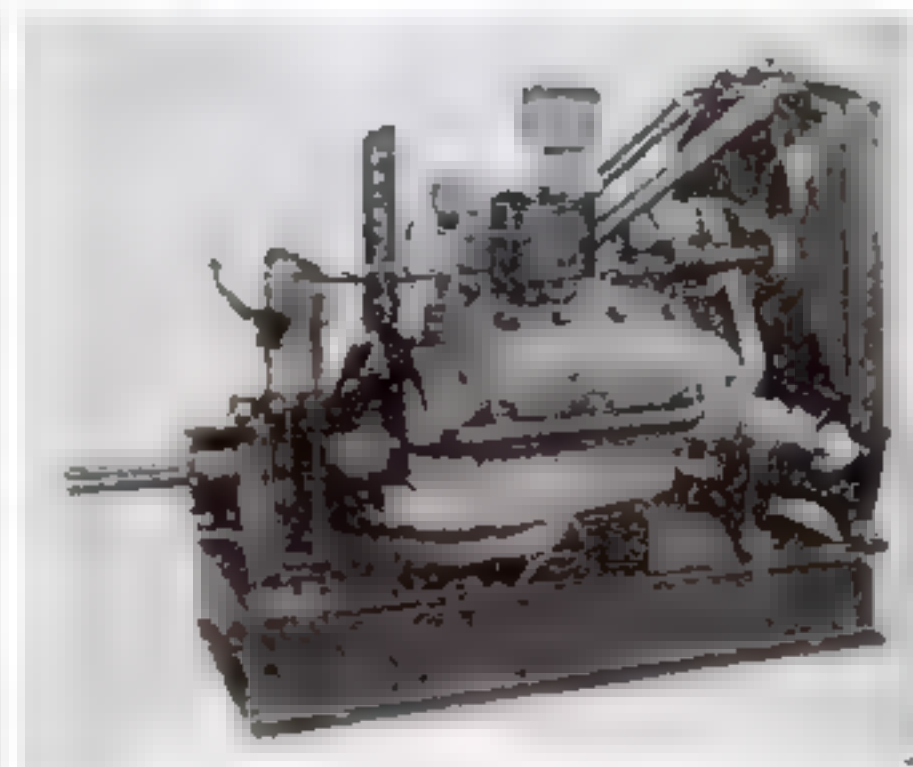
Before the top is finally bolted on, provision must be made for the vises. Good commercial vises are desirable but costly, so the vises in this case are home-made. Two ordinary iron bench screws are required. They are available at any large hardware store. The standard diameters of the screws are 1, 1 $\frac{1}{4}$, 1 $\frac{1}{2}$, and 1 $\frac{3}{4}$ in., and any of these sizes is satisfactory. The screws, which come complete with handles, are installed as shown. The tail vise may be omitted.

The vise ways and way guides serve to keep the jaw of each vise from turning with the screw and also to keep it parallel to the faceplate. The faceplate is a hardwood piece screwed on the bench, through which the ways slide.

Two metal dogs may be purchased to fit in holes placed where indicated in the bench top. Square wooden dogs will serve as substitutes if necessary.

The bench top, vise jaws, and faceplate may be treated with several coats of raw linseed oil, and the screws should be lubricated with a little hard oil or vaseline.

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End Table with Tray

(Continued from page 96)

gether, they should be screwed to the shelf. The lower brace is next to be fitted and fastened with screws driven diagonally upward from underneath. The $\frac{1}{4}$ by $2\frac{1}{2}$ -in. flats should then be fitted and glued to the flat side of the turned posts.

Two pieces of $13/16$ by $2\frac{1}{4}$ -in. stock are cut for the ends of the tray, and two pieces $13/16$ by $\frac{1}{4}$ by $23\frac{1}{4}$ in. for the sides. The ends are mortised into the sides. If the vertical spindle shaper is used, it is necessary merely to lower the spindle to make the grooving cut, once the tenoning cut has been made. After the tray has been glued up, the outside is rounded on the corners and molded. The inside shape at the ends is jig-sawed, and the glass rabbet cut on the shaper.

The mirror is held in with $\frac{1}{4}$ -in. bass plywood fastened with fine screws that are driven diagonally into the frame. The $\frac{3}{8}$ -in. dowel set in each tray support is rounded on the end to enter a corresponding hole in the frame of the tray. The tray handles are screwed to the frame from underneath.

Cover the bottom of the tray with felt. The molded edge of the shelf and the tray handles may be stained black with good effect, if desired.—DONALD A. PRICE.

Long Extension Lamp Cords Hazardous in the Shop

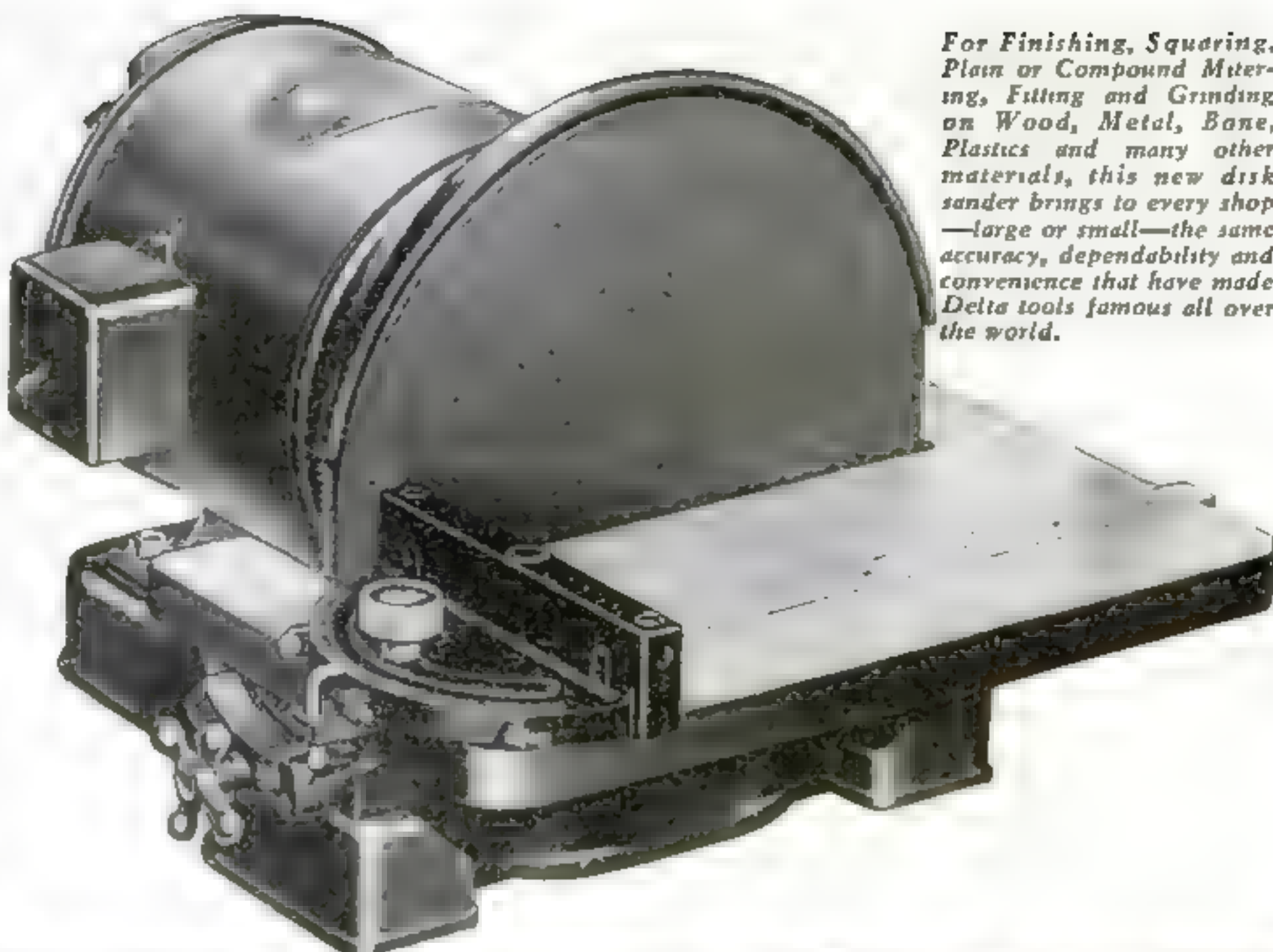
To OBTAIN electric light wherever needed in their home workshops, some amateur mechanics rig up long extension lamp cords which are draped over hooks or nails. Sometimes the cord is carried over a pulley and provided with an extra sliding pulley and weight to take up the slack automatically.

No electrical inspector would approve such expedients. A portable cord should never be hung over a metal hook because of the danger of chafing the insulation. A heavy weight is bad because it puts a strain on the cord.

There is no substitute for providing the necessary number of permanent outlets. However, if a long adjustable cord is needed, cord reels are available that can be attached to a junction box. They contain a quantity of cord on a reel so designed that it causes the cord to catch at any desired length.—H. S.

Screw-Point Tool Removes Rag Stuck in Rifle

WHEN a cleaning rag becomes stuck in a rifle, it can usually be removed with a homemade tool that works on the corkscrew principle. Obtain a length of 14-gage or slightly heavier copper or coppered wire. The length should be about 6 in. longer than half the length of the barrel. From a ring at one end to serve as a handle and for hanging the tool up. To the other end, solder a brass wood screw of the same thickness as the wire, after the screw head has been cut off. Tear an old rag into strips and wind them around the wire until it is an easy fit in the barrel. This protects the rifling of the barrel and centers the screw. Now insert the tool in the bore, press, and turn to right. When you have felt that the screw has bit into the obstruction, draw the rag out.—I. H. STRACHAN.



For Finishing, Squaring, Plan or Compound Mitering, Fitting and Grinding on Wood, Metal, Bone, Plastics and many other materials, this new disk sander brings to every shop—large or small—the same accuracy, dependability and convenience that have made Delta tools famous all over the world.

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The skill and ingenuity of Delta engineers is exemplified in this new 12" Disk Sander which is featured in the new 1938 line of Delta motor-driven tools. Not merely another sander, this quality tool is designed to meet every requirement for ACCURATE convenient sanding. From its specially machined, true-running 12" disk to its unusually large tilting table, its husky spindle carried on self-sealed ball bearings, this latest Delta tool is built for long life, low power consumption, accurate dependable results and maximum convenience in operation. Available in two models: *Direct-drive*, using the Delta $\frac{1}{2}$ h.p. motor with disk fitted directly onto the motor shaft; *Belt-drive*, for those who wish to use their own motors, or for use in districts where odd frequency or odd voltage motors must be used. (This belt-drive model permits speed to be suited to individual sanding or grinding requirements.) The full story of this unusual tool, together with specifications and prices, is found in the new Delta 1938 Catalog. Send for it today!



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New 14" metal-cutting band saw. Takes the place of power hack-saw. Cuts almost any material. A remarkable time and money-saving tool.

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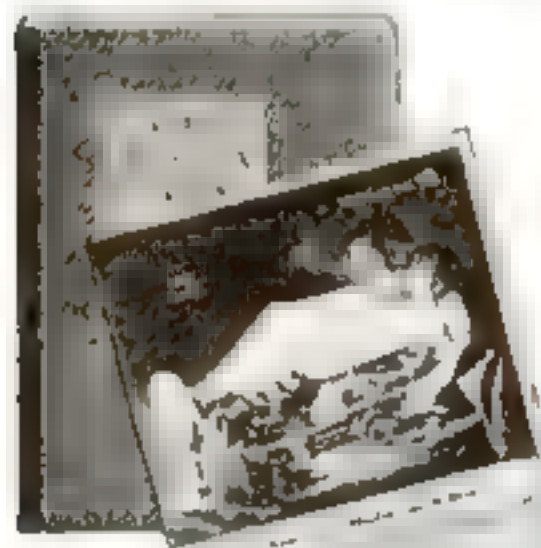


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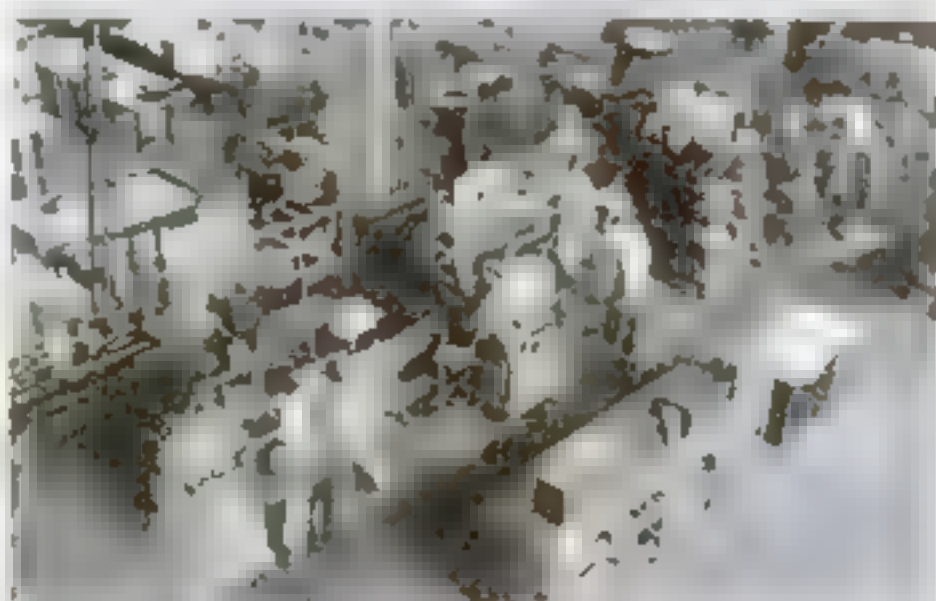
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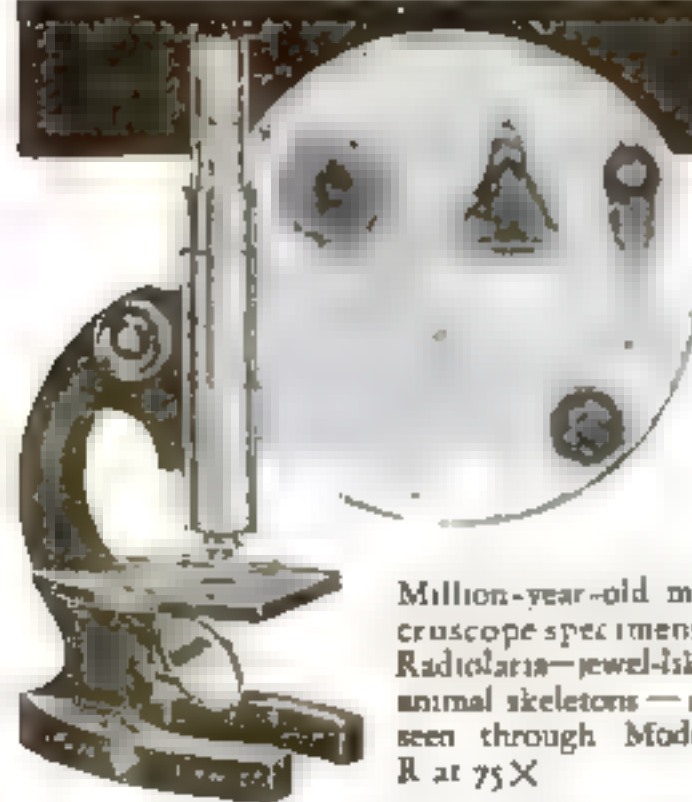


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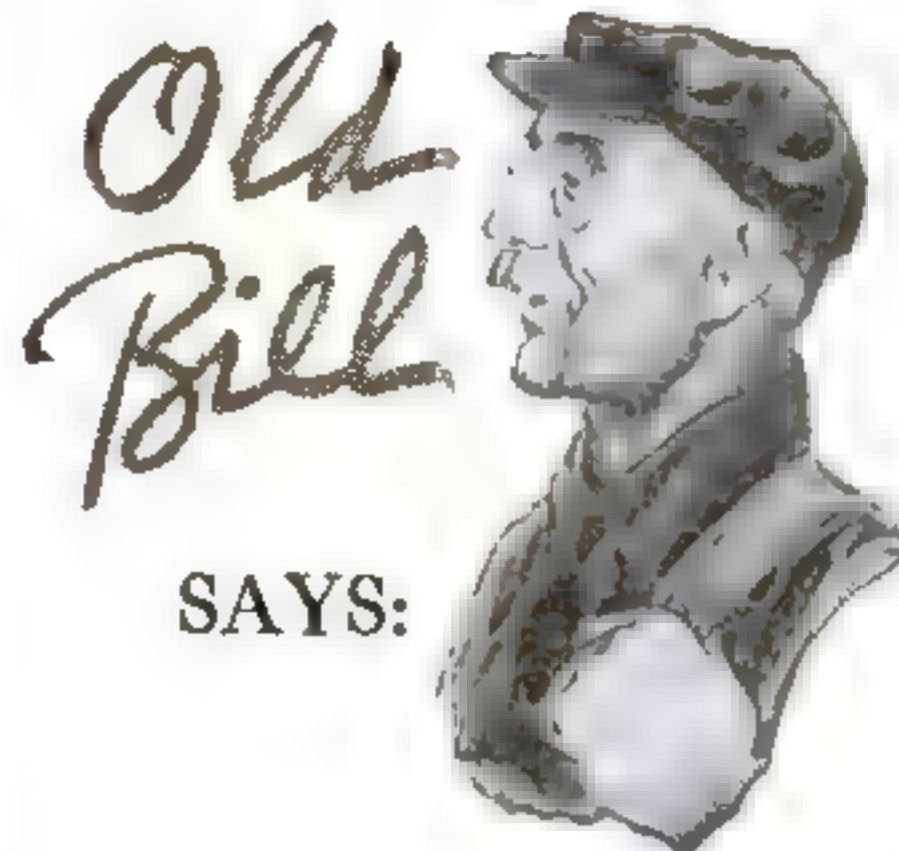
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SAYS:

BEFORE pressing soft steel pins into parts of similar material, coat them with copper sulphate. This fills up any slightly irregularities in the surface of the pins and prevents the metal from galling or tearing. Furthermore, pins treated in this way are not likely to become rusted in.

Never oil welding equipment, and keep all oil and grease away from it so as to avoid the danger of fire and explosion.

Although the initial cost of rocker-type motor bases is higher, the more efficient performance made possible by this type of mounting offsets the cost within a short time.

Nitric acid produces a black spot on steel, and the darker the spot, the harder the steel. Unlike steel, iron remains bright when touched with nitric acid.

Cotter pins, bolts, nuts, washers, taper pins, and other small machine parts are now made from stainless steel. They come in handy where corrosion is an important factor.

Brass or bronze bushings or studs, if turned by error slightly too small for the parts into which they are supposed to be a press fit, can usually be brought to the desired size by tinning them with a little solder.

When hardening die- or tool-steel parts containing tapped holes, take the precaution to screw steel plugs of low carbon content into the holes beforehand. These will prevent the threads from shrinking and becoming distorted in the hardening process. The soft steel plugs are readily removed after the work has been hardened.

Never drive dowels into blind holes if it is possible to drill the holes right through. At some future time the dowels may have to be driven out.

Machine design loses something of its mystery if the beginner in shopwork remembers that the most complicated device is a combination of only two motions—reciprocating and rotary.

For lubricating the cutting edges of tools used for very fine work, castor oil or whale oil is preferable to cheaper lubricants.

Machine set-ups of a complicated nature can be made clearer to new workers by supplementing the blueprint and instruction sheets with a photograph of each set-up.

Save the cuttings and waste material left over when gaskets are made from sheet asbestos. If moistened, this waste asbestos can be wadded into a ball of the consistency of dough and used for repairs around furnaces, automobile mufflers, and the like.

Inexpensive Equipment for Lighting a Stage

(Continued from page 113)

together with tape a core of short iron wires in such a way that the latter may be slipped in or out of the helix. You can put this in a space of about 15 by 5 by 5 in.

AN ALTERNATE method of making a dimmer is to use a 1-gal. crock filled with salt water. Cut a sheet-metal triangle just large enough to go into the crock. Attach a cord to the triangle, and by means of a pulley or wooden shaft, provide for moving the sheet-metal triangle in and out of the salt solution as shown. For the other connection, merely bend a strip of sheet metal over the top of the edge of the crock so that the metal extends down into the salt water. This is a cheap type of dimmer, easily constructed. By experimenting with the proportion of salt in the water, you can determine the amount necessary to carry the load.

If you wish to build your switchboard in a galvanized-iron box and use a galvanized-iron panel, the basic plan is the same, but there are a few minor changes. The controls in each circuit are mounted so that the supporting bracket for each row of outlet switches and dimmer plugs forms a continuous strip of metal, which acts as a stiffener.

When the circuits are assembled, one side of each outlet and switch should be wired with one continuous wire, and the opposite side of the outlets and switch provided with leads as illustrated. The leads are bolted to the panel so that they are in a position to be connected to a No. 10 main-line wire leading to the main switches.

BECAUSE of the possibility of shorts and shocks on open knife switches, it is advisable to use standard parts of a sufficient capacity in all circuits, and the switches should preferably be of a silent type. The transformer, bells, and buzzer can be mounted on the back of the box, and long enough leads can be provided to allow the panel to be swung on hinges at right angles to the box.

The cost of the two types of switchboards is approximately the same, and the weight is about 20 lb. each.

Baby spots can be easily made. Get a No. 10 can and fasten it to a piece of "two-by-four" about 18 in. long. In the bottom of the can fasten a two-piece sign socket, or hold the socket by means of wires. At the end of the board, in front of the open can, nail a piece of tin doubled over twice so as to hold a slide made of transparent cellulose wrapping material in a pasteboard frame. By using such frames, you can have any color of light you need. If you desire a more powerful reflection, paint the inside of the can with aluminum paint. Use a 60-watt bulb.

If you want to project and converge the light, a can may be slit lengthwise, the top and bottom removed, and the tube inserted in the open end of the baby spot, telescope style.

For portable footlights, if required, get two No. 10 cans, cut them in half lengthwise, and nail them to a piece of "two-by-four," 6 ft. long. This will make four reflectors about 18 in. apart. The top of each half can should be slit down and doubled over to form an arched top, as shown.

UTTERLY NEW CAR HEATER HEATS HOT IN 90 SECONDS

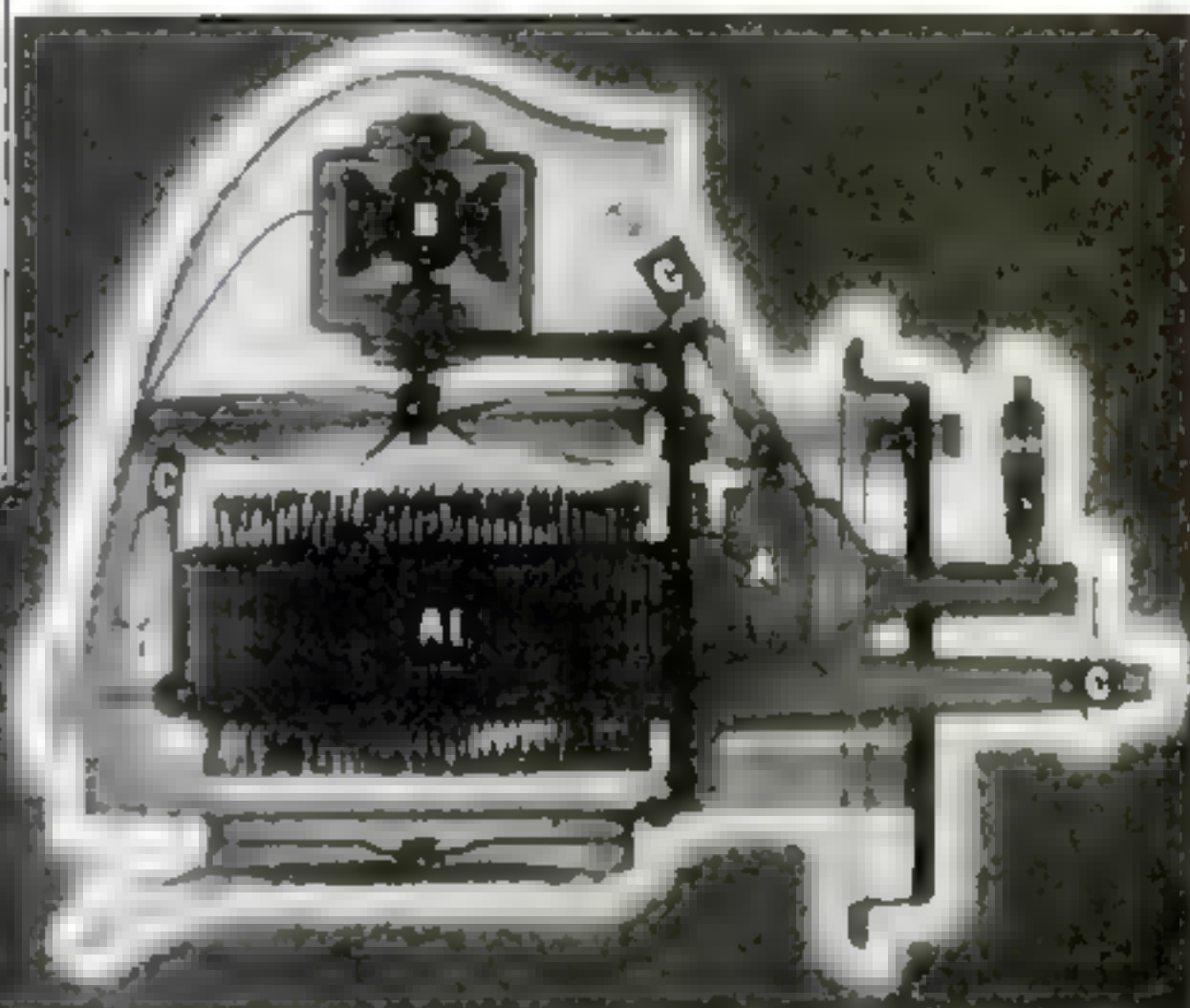
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Note automatic controls C.



● Here's the most amazing development in car-heater history! An utterly new kind of heater that gives billows of warmth in 90 seconds by the stop watch, long before your engine warms up! And that gives more heat, too!

This Stewart-Warner South Wind Heater is hotter and faster because it works a brand new way—burns gasoline in a patented, sealed metal chamber at an average cost of only $\frac{3}{8}$ of a cent an hour. And its safety is proved by the famous seal of Underwriters' Laboratories, Inc.

Vacuum from the manifold draws gasoline into the sealed chamber, and draws out the burned gases. An electric igniter lights

the heater automatically—then shuts off automatically, so there's no heavy drain on the battery. A single control knob starts and stops the heater, and adjusts temperature.

Installation is simplified because the South Wind heater is totally independent of the cooling system. There's no hose cutting, no extra thermostats to buy, no added loss of anti-freeze through increased leakage or evaporation.

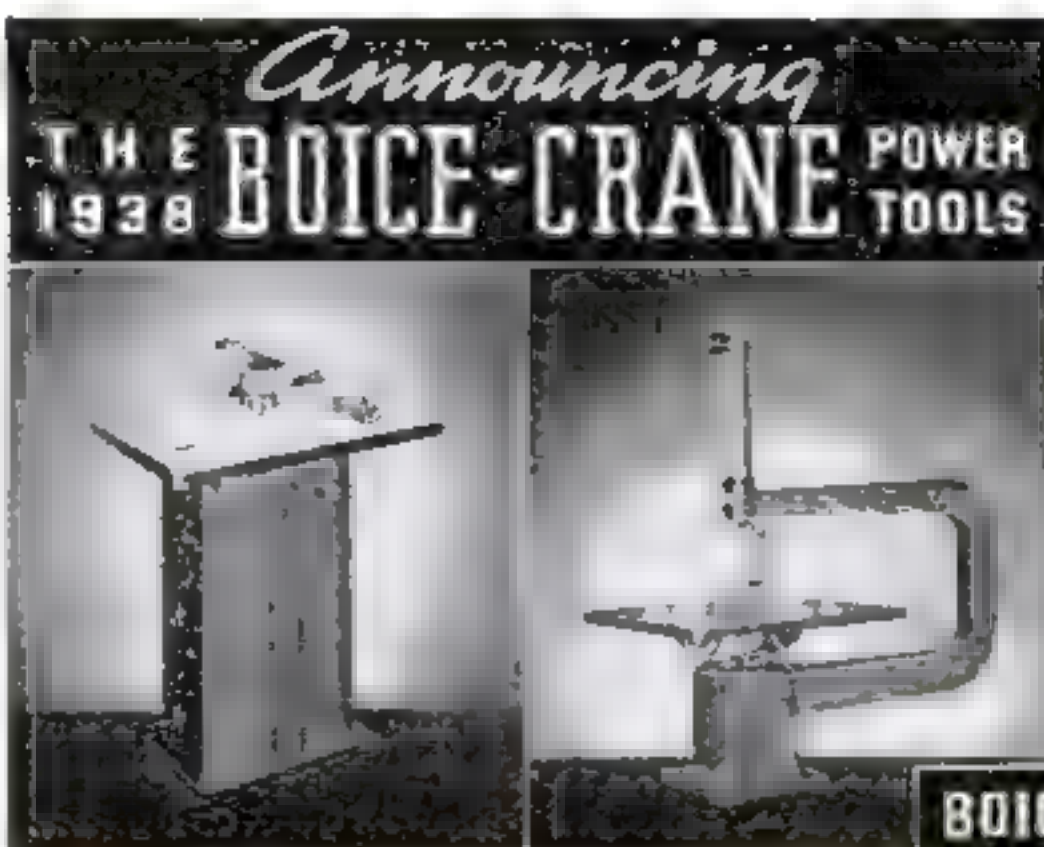
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1938 FEATURES

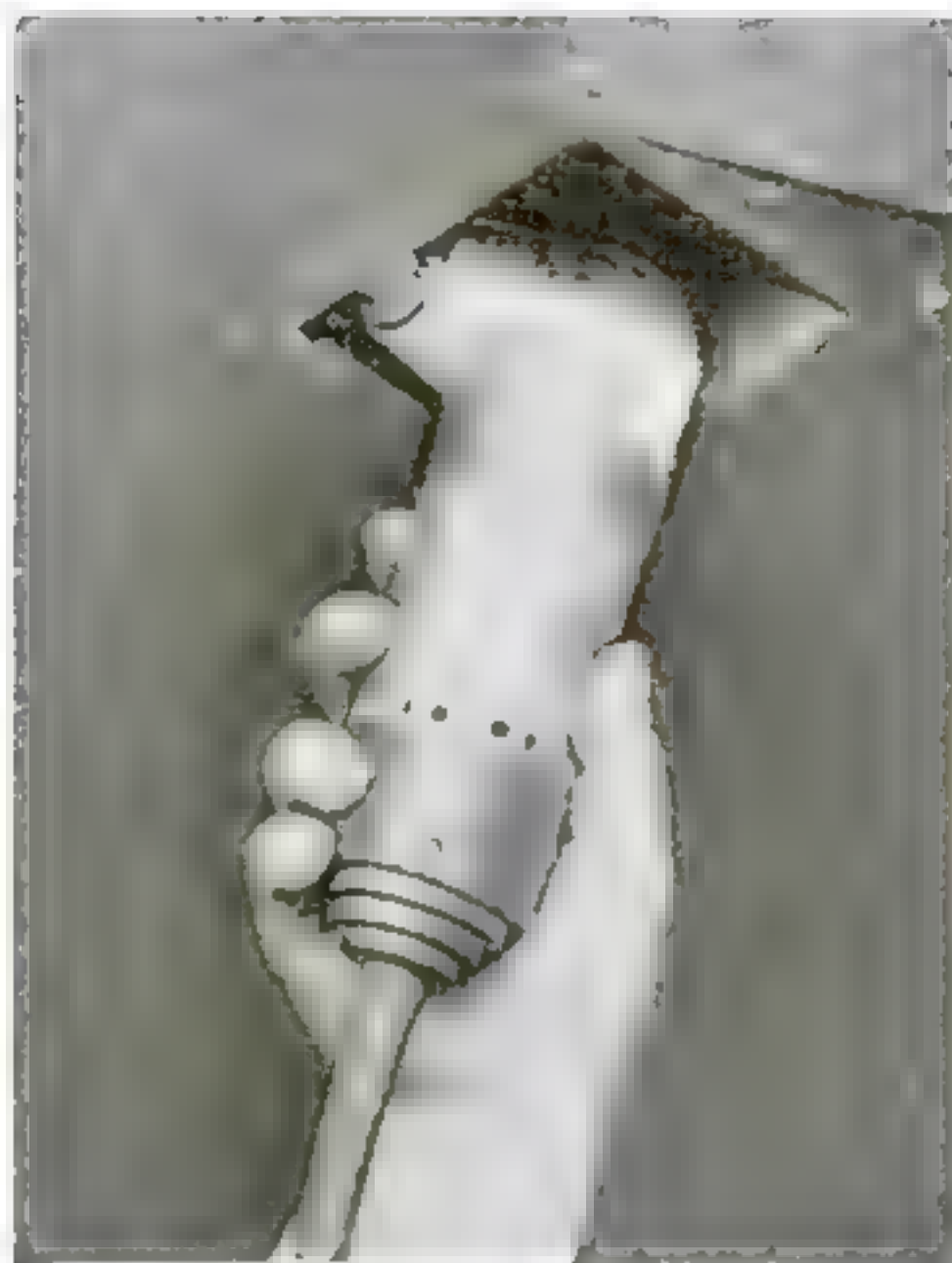
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Occupation.....

Address.....

City..... State.....

New Locomotive Model

(Continued from page 91)

act as bearings, allowing the wheels to move up and down.

The trailing truck which, on the real locomotive, also carries the booster, is begun by temporarily soldering together two strips of 1/32-in. sheet brass about 1/4 by 1 1/4 in. Cut to the rough outline shape with tin snips, then drill and file to the finished shape. The bracket is annealed brass and is soldered to the side frames after the wheels are put in place.

Both trucks are held down against the rails by very light coil springs that fit over the pivot screws. Put a washer beneath each spring, and make sure the trucks have plenty of freedom.

The pivot for the pony truck is a 2-56 screw. If you have a 2-56 tap, drill a No. 50 hole in the main frame between the two nuts that hold down the cylinder block, and tap it 2-56 for this pivot. Otherwise, file a 2-56 nut so it will fit in this space and solder it in the center of the frame between the nuts just mentioned. This soldered nut may have to be filed down slightly to fit.

This completes the chassis of the locomotive, and it is ready for the superstructure, to be described next month.

LIST OF MATERIALS

For	Material	Size
Frame, etc.	brass	1/4 x 1/4 x 21
Cylinder block	brass	3/8 x 3/8 x 1 3/8
Boiler	thin-wall brass tube	1 in. outside dia. x 4 5/8
Smokestack	brass tube	5/16 in. outside dia. x 1/4
Steam dome	brass rod	1/2 in. dia. x 1/4
Air tanks, etc.	brass rod	1/2 in. dia. x 6
Cylinder heads	brass rod	5/16 in. dia. x 1
Pilot beam	square brass	1/2 x 1/8 x 1 1/4
Sheet-metal parts	sheet brass	1/32 x 12 x 12
Sheet-metal parts	sheet brass	1/64 x 12 x 12
Handrails	brass wire	0.032 in. x 24
Crosshead guides	brass wire	0.040 in. x 10
Contact shoes	brass wire	0.075 in. x 6
Motor con- nections	insulated copper wire	24
Springs, light coil	steel	(2 req.) 1/8 in. dia. x 1/2
Springs, heavy coil	steel	(2 req.) 3/32 in. dia. x 3/4
Washers	brass (1 doz. req.)	to fit over 2-56 screws (3/32- in. holes)

MISCELLANEOUS

1 pc. vulcanized fiber, 1/16 x 1/4 x 2.
8 cotter pins, 1/32 (or small lills).
8 escutcheon pins, smallest size.
Brass screws: 1 1/2 doz. roundhead 2-56 x 1/4; 1 roundhead 2-56 x 3/8; 2 flathead 2-56 x 1/2; and 2-56 nuts for all.
2 long and 4 short 0-80 steel shoulder screws for crankpins.
Boiler head—a casting or turned from brass.
Ladder strip, 1/4 in. wide, about 5 in. long.
Wheels: 6 driving, 3/4 in. dia., with 3 axles; 1 pair for trailing truck, 1/2 in. dia., with axle; 9 pair for truck, 13/32 in. dia., with axles.
Worm and gear, 30 to 1 ratio.
Motor, 6 volts, direct current, battery type.

NOTE: All dimensions are given in inches. The parts are all stock materials except the wheels, motor, gears, ladder strip, and boiler head. If you have a lathe, the only manufactured parts required are the motor and gears.

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RELAX!—let the Western Electric Audiophone bring you every word clearly. This instrument, designed by Bell Telephone Laboratories, is giving greater ease and happiness to thousands who were hard of hearing. A dealer, trained in Audiometric testing, will fit you properly with air or bone conduction receiver—which ever your case requires.

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Please send details on Western Electric Audiophone and name of nearest dealer.

P-32

Name.....

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The Truth About Poison Gas

(Continued from page 33)

deadly and its being harmless, just as carbon monoxide gas from automobile exhausts is deadly in a closed garage and harmless in the street. Fortunately, asphyxiating or "killing" gases like phosgene must be present in high concentration to become any great hazard, and are therefore not to be feared in air raids on cities.

Mustard gas and geranium-scented lewisite, a newer blistering gas, might be dropped in bombs and would be decidedly unpleasant to encounter. Neither is usually fatal, however, and people caught on a city street when a gas-raid alarm was sounded could find instant shelter in tall buildings and would be safe from these gases a few stories above the street with windows closed. After a raid, special squads in masks and protective clothing would block off the gassed areas with danger signs, closing them to traffic, and set about "decontaminating" them by hosing the poison down the sewers or destroying it with scrub brushes and chloride of lime.

ABOUT the greatest harm to be feared from an aerial gas raid on a city, therefore, would be the terrorizing of the more excitable inhabitants. For this purpose, army tacticians probably will use the relatively harmless tear and sneeze gases, for they do their work at lower concentrations and in smaller quantities than other war gas.

Civilian preparedness has gone a long way toward removing the horrors of gas attacks on noncombatants. Mimic air-raid drills, the building of gas-tight refuges, and the distribution of masks have acquainted the man in the street with the various methods of gas defense. In Great Britain, "gas schools" and educational exhibits are teaching city dwellers how to use one room of a house as a gasproof shelter. In case of an air raid, the entire family can move into it and seal it air-tight with newspapers and blankets, using gas masks only if necessary as a second line of defense.

Evidently, we do not need to worry much about gas attacks at home. As for soldiers on the battlefield—well, that is another story.

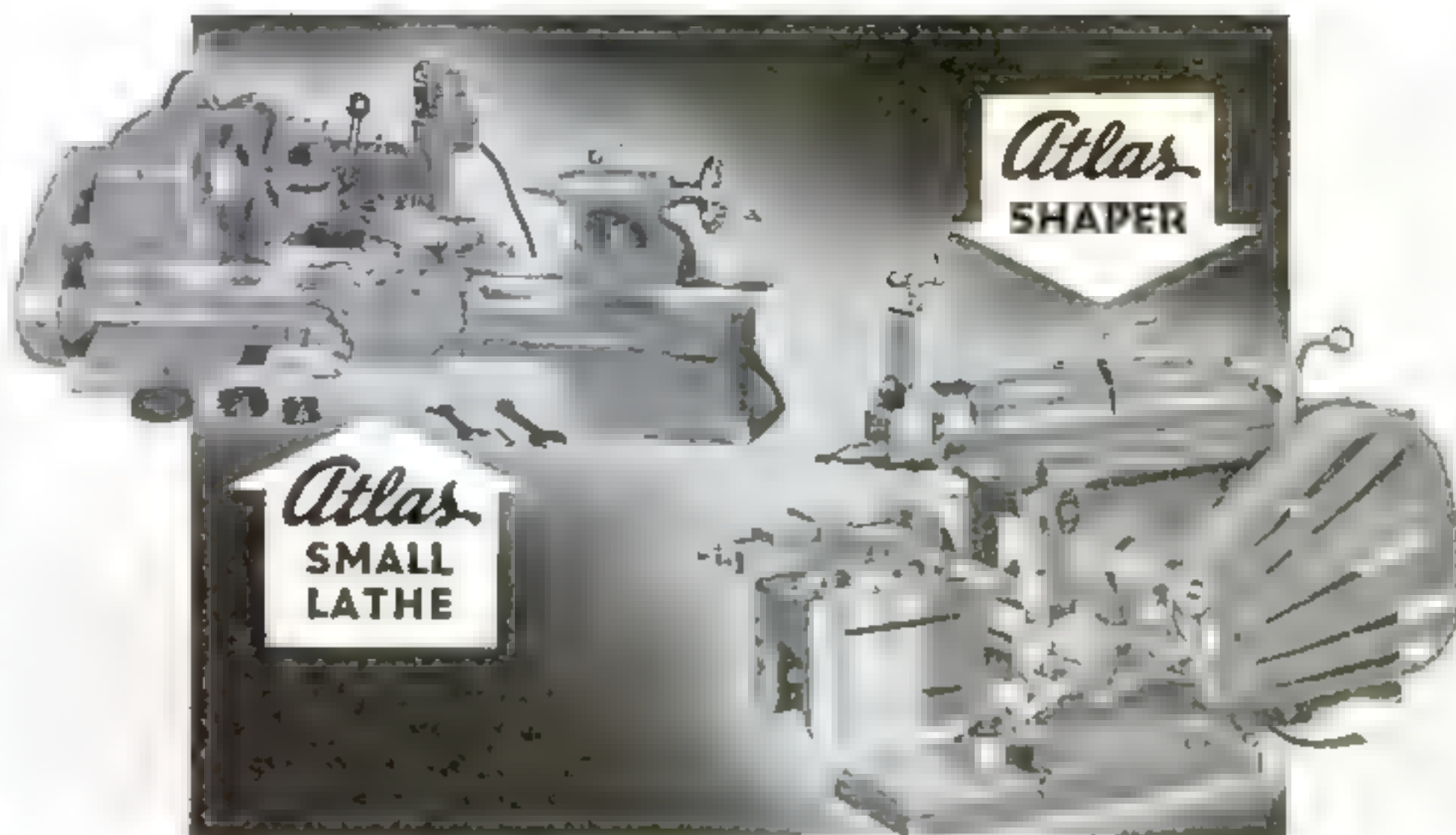
USING every known gas against enemy troops, air raiders may completely revise the tactics of warfare. Troops will have to be moved to the front by motor truck instead of by train; fixed terminals offer targets too promising for aerial gas attacks. If planes discover and attack the motorized columns, the men will not know whether to scatter for safety from explosive bombs or to stay in their vehicles for cover from gas bombs or spray.

Other new gas weapons will add to the soldier's woes. Chemical land mines will be exploded, and areas sprinkled with liquid poison from motorized tank wagons, to block an advance. The latest compressed-gas cylinders for releasing wind-borne clouds of poison gas from front-line trenches have "silencer nozzles," eliminating the high-pitched hissing noise of world-war cylinders that gave warning five to twenty seconds before the gas arrived.

That is the picture of up-to-date gas warfare, according to those who are in the know. (Continued on page 138)

Atlas

Announces 2 New Precision MACHINE TOOLS



Atlas makes news again! The same creative engineers that developed the sensational Atlas values in metal working lathes and drill presses now present two amazing new precision machine tools—a new Atlas Small Lathe for model makers, jewelers, tool and die shops—and the new Atlas Bench Shaper that combines all the performance features of larger machines in one complete compact tool.

The Atlas Small Lathe

There's never been a lathe like this before. All the famous features of the larger Atlas lathes have been refined down to make this small deluxe model.

It's a back-geared screw-cutting lathe with 16 speeds, reversible power feeds, integral countershaft, V-belt drive, Timken bearings, and a host of other features that make it a marvel of mechanical perfection.

There are two sizes—both with 6" swing—12" between centers, and 18" between centers. But here's the biggest news—the prices are \$59.50 and \$64.50, complete less motor. Send the coupon today for full details.

The Atlas Bench Shaper

The new Shaper for tool rooms and shops is outstanding in two important respects. First, it gives you all the precision and power of large machines, built down to scale for greater efficiency and versatility on small work. Second, its price of \$215.00 sets a new standard of value in metal shapers.

It has a 7" stroke with complete V-belt drive from motor to spindle. 4-step countershaft and pinion-shaft pulleys provide 4 speeds between 45 and 200 strokes a minute. For complete infor-

mation check the coupon and mail it today.

"Make Yours an Atlas Shop"

The addition of these two new machine tools now enables you to secure complete modern precision metal working equipment from one dependable source—lathes ranging in capacities from 12" to 36" between centers, 4 sizes of drill presses, arbor presses, motors and grinders, tools and attachments—and all at the unusual values made possible by modern Atlas engineering. Send this coupon for free 1938 Catalog.

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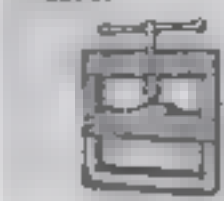
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then he gained
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—Walter Schoendaller,
La Crosse, Kans.

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by
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New IRONIZED YEAST tablets give thousands 10 to 25 lbs.—Quick!

NOW thousands of skinny, rundown persons can say goodbye to unsightly bones, certain skin eruptions and lack of pep, which rob them of natural attractiveness and friends. For with this new easy treatment great numbers have put on normal good-looking pounds, cleared their skin naturally, gained new pep—in just a few weeks!

Although this new scientific formula, Ironized Yeast, was developed and perfected at the cost of many thousands of dollars, it comes to you in pleasant little tablets which cost you only a few cents a day!

Why they build up so quick

Doctors now say thousands are thin and rundown only because they don't get enough yeast vitamins (Vitamin B) and iron in their daily food. Without these vital elements you may lack appetite and not get the most body-building good out of what you eat.

Now, by a new process, the vitamins from the special rich yeast used in making English ale are concentrated to 7 times their strength in ordinary yeast. This 7-power vitamin concentrate is combined with 3 kinds of iron (organic, inorganic and hemoglobin iron). Pasteurized English ale yeast is then added. Finally, for your protection and benefit, every batch of Ironized Yeast is tested and retested biologically, to insure its full vitamin strength.

The result is these marvelous little Ironized Yeast tablets which have helped thousands of the skinniest people who needed these vital elements quickly to gain normally attractive pounds and new peppy health.

Make this money-back test

If, with the very first package of Ironized Yeast, you don't begin to eat better and to get more enjoyment and benefit from your food—if you don't feel better, with more strength, pep and energy—if you are not convinced that Ironized Yeast will give you the pounds of normally attractive flesh you need—your money promptly refunded. So get Ironized Yeast tablets from your druggist today.

Special FREE offer!

To start thousands building up their health right away, we make this absolutely FREE offer. Purchase a package of Ironized Yeast tablets at once, cut out the seal on the box and mail it to us with a clipping of this paragraph. We will send you a fascinating new book on health, "New Facts About Your Body." Remember, results with the very first package—or money refunded. At all druggists, Ironized Yeast Co., Inc., Dept. 4511, Atlanta, Ga.

WARNING: Beware of the many cheap substitutes for this successful formula. Insist on the genuine Ironized Yeast.

The Truth About Poison Gas

(Continued from page 137)

Horrible? Humane? Much depends upon the point of view.

There is nothing particularly humane about blowing men to pieces with high explosives and riddling them with bullets and bayonets, leaving them to expire in agony or to survive as mutilated physical wrecks. In contrast, chemical-warfare men maintain, gas causes less suffering, and leaves a man whole.

Contrary to popular belief, gas seldom causes permanent injuries or after effects. One common idea is that gas predisposes its victims to tuberculosis, but a medical investigator tracking down this belief actually found half again as many cases of tuberculosis among soldiers who had not been exposed to gas as among soldiers who had been gassed!

AS FOR the deadliness of gas compared to other means of waging war, World War figures show that only two percent of the total gas casualties were fatal, while more than twenty-five percent of casualties from all other causes resulted in death. In other words, a soldier incapacitated by gas had more than twelve times as much chance of escaping with his life as a soldier wounded by other weapons.

However effective it may prove on the battlefield, for the civilian at home in a city far behind the lines the menace of gas appears to be much less than sensational writers would have us believe. Even if this weapon should be used extensively in another war, its natural limitations and the improved defensive methods probably would do much to rob it of its terrors.

Hunting Lost Worlds

(Continued from page 43)

colonies, just as pools are left by the ebbing tide of the ocean.

When A. Conan Doyle wrote his imaginative story, "The Lost World," he laid the action on the rocky, mist-enshrouded summit of Mount Roraima, a peak that straddles the boundary between Brazil and Paraguay, in South America. A few years ago, scientists from the American Museum of Natural History set out to scale this jungle peak. In an Odyssey of exploration they crept for days up slanting ledges of rock, losing their way in the interminable mist of the mountain top and having their shoes cut into ribbons by the grinding sandstone. After reaching the top, they spent weeks studying the creatures that live on the twenty-five square miles of the summit. When they returned to civilization, they brought varieties of bird and animal life hitherto unknown to science.

EXPEDITIONS such as this, and the one now flying westward to scale Shiva Temple in the Grand Canyon, comprise a doubly dramatic form of exploration. The scientists do more than penetrate hitherto unknown areas. They penetrate the world of the remote past as well. By discovering ancient forms of life, they seek to turn back the pages of history millions of years, enabling us to visualize more clearly the lost world of prehistoric times.

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EXCELSIOR

Behind the Scenes at Circus Winter Quarters

(Continued from page 52)

yards of velvet, 4,000 yards of silk, hundreds of yards of plush, about six miles of feathers, 1,000 yards of cellulose film, several hundred gross of decorative disks, and enough thread to circle the earth several times. While on tour, a crew of nearly thirty men and women takes care of the costumes and makes the minor repairs needed.

One of the most unusual workers at Sarasota is "Waxie" Panza, head of the harness department. In spite of the fact that he has been blind for twenty years, he is recognized as one of the crack harness men of the country. Under his direction, several hundred harnesses are made each year. More than 300 ring horses and 400 draft animals travel with the circus during its summer tours.

AS YOU wander from building to building at the Florida camp, you find grooms currying horses; mechanics tuning up midget fire engines; electricians overhauling generators and loudspeakers. Blacksmiths are hammering out fittings and wheelwrights are busy repairing vehicles of various kinds. In the woodworking shop, expert carpenters are turning out circus "props" that run the gamut from pedestals for trained seals to harps for tableau performers and trick folding houses for clowns.

A little farther along is the main wagon shop where as many as sixty vehicles a month are rebuilt. They range all the way from ticket wagons and wheeled animal cages to mobile kitchens, pageant phaetons, and the great rolling bathtubs which hold the seals, hippopotamuses, and polar bears.

Most circus wagons carry spare wheels slung underneath on chains. Of necessity, such wheels are heavy and rugged. It takes two men to handle the bigger ones. At the Sarasota camp a giant hydraulic tire-setting machine shrinks steel tires into position on the big wooden wheels. It has a battery of more than a dozen plungers, driven by oil pressure. They push against the tire from all points of its circumference and are able to shrink into place a cold-steel rim half an inch thick. If the apparatus presses a trifle too far, it will crush the heavy wooden wheel as though it were a walnut.

VISITORS at the camp are permitted to wander from building to building. They see trick horses being trained, newly painted lion cages being wheeled into line to await the start of a new season, elephants standing on their heads, and ninety railway cars being cleaned and renovated. At one place, a six-horse team of lively ponies is being hitched to a mirror-covered cart. At another, men are adjusting a showy blanket on the back of a patient elephant. On every hand, there is something of interest going on. A trip to the winter quarters is almost like being in the arena when a circus is going on.

Oftentimes, as many as 1,000 people a day pass through the gate into the Ringling Brothers camp four miles north of Sarasota. It, and the winter quarters of other shows scattered throughout the country, offer the circus lover a chance to watch the fascinating behind-the-scenes activity which, each year, rebuilds the circus and maintains its smooth-working efficiency.

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LADS from eight to eighty find a new thrill in the building of a short wave or all-wave radio. Mom, Sis and the entire family find added enjoyment and pride in listening to it. **THE MEN OF THE FAMILY HAVE PROVIDED A SOURCE OF ENJOYMENT FOR THEIR HOME.** And the **BIG, FREE 1938 Catalog** made it possible by pointing the way to effortless, economical buying of kits, parts, tubes, everything in radio.



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The compact design and light weight of this engine and its "Quality" construction which includes a counter balanced crankshaft, ball bearings, and a sensitive flyball governor, makes it the logical choice for operating bicycles, washing machines, small generator sets, water systems, centrifugal pumps and countless other installations where dependable, economical power is required. SPEEDS—1800 R.P.M., 2400 R.P.M. and 3600 R.P.M.

This engine is suitable for powering mid-gt cars, scooters, bicycles and other home projects. The price of this complete engine (needs only gas and oil to operate) is \$40.00 F.O.B. New York. Send only \$2.50 and we will ship C.O.D. for the balance.



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WINCHESTER

Know Your Battery!

(Continued from page 88)

"will lose about one percent of its charge every day it stands idle. So it isn't hard to see why a cheap job with poor separators and impure chemicals is no good. It has such big internal losses that it'll go dead in no time."

"Gosh, there's more to this battery business than I thought," Walsh observed, chewing the end of his cigar. "But if the weight doesn't mean anything, how in blazes can you tell a good battery from a bad one?"

"The answer is, you can't," Gus smiled. "At least, there isn't any test that the ordinary car owner can apply that will mean anything."

"Come in here a minute," he suggested, beckoning toward the little store-room where the garage's supply of new batteries was kept.

"TAKE a look at these. We've got three different grades of batteries here. Can you tell me which is the best just by looking at them?"

Walsh puffed his cigar thoughtfully as he glanced over the shelves. "You've got me, Gus," he admitted, after a little deliberation.

"Of course you can't, and neither can I, just from outside appearances," the veteran mechanic confessed. "The only thing you can really go by is the reputation of the maker."

"And the honesty of the dealer," chimed in Joe Clark, who was checking some of the stock in the store room.

Gus and his customer walked back to the charging stand. "What about a hydrometer?" Walsh asked, lifting the glass-and-rubber instrument from a rack on the wall. "Doesn't that tell you anything about the quality of the battery?"

"Not a thing," Gus kicked Walsh's old battery with the toe of his heavy work shoe. "I could make this piece of junk give the same hydrometer reading as a brand-new, fully charged, battery. All I'd have to do is add strong acid to the cells. That would make the specific gravity, which is the thing a hydrometer measures, the same as for a good battery. And, as a matter of fact, the battery actually would give juice—for a short time, anyhow."

"But, Gus, there must be some way for an expert to tell how good a battery really is," put in Walsh. "Couldn't he just connect some lamps to it, and see how long they stay lighted?"

"That would tell just one thing about a battery," Gus explained. "—Its ampere-hour capacity. But an automobile battery has to do more than just light lamps. That's just dribbling the current out. The starter takes a whale of a lot of current out of the cells all at once. So you'd have to test the battery at a high discharge rate, too."

"THAT doesn't make sense to me," objected Walsh. "If a battery will hold a certain number of ampere hours, what difference does it make whether you draw off the current slow or fast?"

He pointed to a pail in the corner. "It's like taking water from that bucket, isn't it? Whether you take it out by the cupful, or whether you dip it out with a spoon, you get just as much water in the end."

"Yeah?" chuckled Gus as he picked up a gallon glass jug marked "Distilled Water."

"Suppose (Continued on page 142)

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Know Your Battery!

(Continued from page 141)

your water was in this jug. You couldn't get the cup in at all, could you? Even if you turned the jug upside down, the water would still come out much slower than if you did the same thing to the pail. You see, a battery doesn't really store electricity—it stores chemical energy. The speed that you can draw juice from it depends on how fast that chemical energy can be turned into electricity.

"An automobile battery," Gus went on, "is like that pail. It'll give lots of current all at once. You need it, too, for starting on cold mornings. But a farm-lighting battery is a lot like the jug. Try to run a car on it, and it'll give out in no time at all. Most likely, the plates would buckle the first time you stepped on the starter."

"SO THEY not only have to find out how much juice the battery will hold," said Walsh. "But they have to see how fast it can deliver that power."

"Now you've got the idea," Gus agreed. "Of course, that's not all—not by a long shot."

The mechanic picked up the specification book again. "There are a lot of other tests these engineers specify for batteries. For instance, a storage cell doesn't work so well when it's cold. So they check its performance at zero temperature, too."

"Is there any way of telling how long a battery is going to last?" asked Walsh.

"That's easy," Gus replied. "All you have to do is keep charging it up, then draining all the current out, over and over again, until the cells give out. If it comes up to the Society of Automotive Engineers specifications, you should be able to do that at least 300 times before she goes dead on you."

"Good grief," exclaimed Walsh. "After you did that, the battery wouldn't be any good any more."

"It certainly wouldn't," Gus agreed. "But when they give that test to a number of batteries picked at random from a manufacturer's production line, it's a pretty safe bet that the rest will last just as long."

The customer puffed his cigar reflectively for a moment. Then he smiled. "Gus," he said, "I've got it all figured out. All I have to do is to buy that battery you tried to sell me a while back. Then I won't have to think about battery trouble for another two years."

"The idea of getting a new battery is O.K.," Gus called over his shoulder, as he started for the storeroom. "But don't stop thinking about the battery when you get it. Remember, a battery needs a drink once in a while."

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Spreading a layer of albumen fixative on a slide to trap a creature in a drop of water

Hunting Little Big Game with Your Microscope

(Continued from page 79)

required for the amœbalike inhabitant. Diffugia can produce pseudopodia at will, and extend them for the purpose of moving about or capturing food. There are numerous other forms taken by the shells of creatures like Diffugia. You will have no trouble finding such shells if they are present in your pond water, for they may be large enough to appear as a tiny speck to the unaided eye.

Arcella vulgaris is an example of a smooth-shelled relative of the amœba. When seen from above, the shell looks like a doughnut; from the side, it somewhat resembles a football. The one-cell animal, which can put out pseudopodia like all its other near relatives, is attached to the shell by tiny strands. Sometimes *Arcella* has a shell marked with undulations.

Flagellate protozoans have one characteristic feature that will enable you to recognize them. They move about by means of flagella, or slender threads extending, like a whip, usually from one end. By lashing these threads about, the creatures draw or push themselves through the water. When only a single flagellum is present, it usually is at the front end. By whipping it about, the animal draws itself along. Many of these organisms have several flagella, some trailing behind and some extending from the side.

A COMMON form of flagellate is *Euglena viridis*. It is a smooth-surfaced, streamline creature with a slightly rounded forward end, from which the flagellum extends. The nucleus is in the center. Usually *Euglena* is green because of the chlorophyll it contains, which is believed to be used by it for manufacturing food just as a plant does. Sometimes the green material is missing, and the animal then apparently gets along by capturing outside food. Near the flagellum end you may be able to make out a red spot. This is called the eye spot because it is believed to be sensitive to light.

Volvox globator appears as a perfectly formed sphere that rolls about in the water on the slide. This creature is really a colony of flagellates, numbering several hundred. The best time to capture *Volvox* is in the spring.

Ciliate protozoans differ from the flagellates by having, as a means of locomotion, a great many short hairs, or cilia, which they manipulate like the scores of oars (Continued on page 144)



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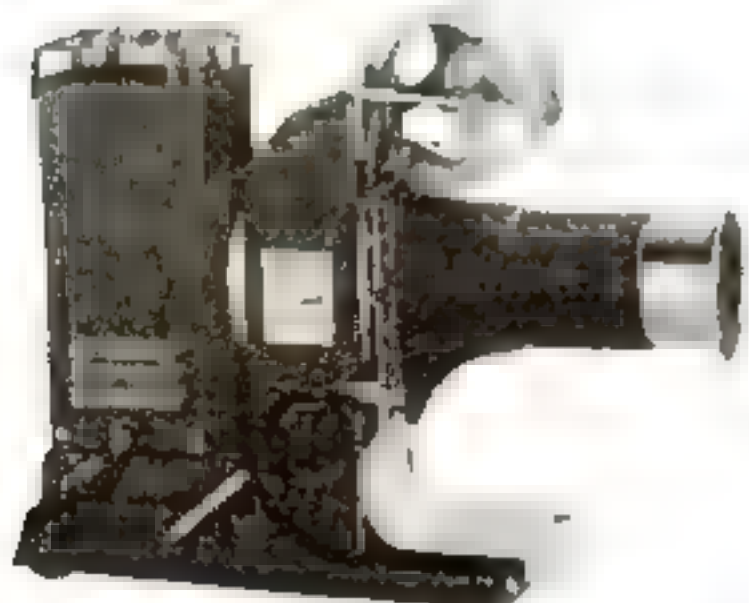
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Hunting Little Big Game with Your Microscope

(Continued from page 143)

of an old Roman galley, to propel themselves through the water or to fan the water past them and bring food particles within reach.

Paramecium caudatum is perhaps the best-known member of this group. It is called also the "slipper animalcule" because it is shaped somewhat like a low shoe. It is characterized by its shape, by being covered uniformly with cilia, and by a slitlike mark along one side. It swims about with a graceful, wavy motion.

WHILE the paramecium is free-swimming, another ciliate, *Vorticella campanula*, anchors itself to some fixed object by means of a slender thread that it can coil up like a corkscrew. In general, it looks somewhat like a bell-shaped lily blossom on a long stem. A ring of cilia around the outer end (ciliary disk) brings food to it. The nucleus looks like a curved band. When *Vorticella* is frightened, as by some object touching it, the stalk contracts suddenly like a released spring, jerking the animal out of the way. At the same time, *Vorticella* folds its cilia inward and contracts into a ball shape something like a strawberry.

Stentor polymorphus is an interesting ciliate that can either swim about or anchor itself to a stone or bit of vegetation. It is shaped like a long funnel. The upper end of the funnel bears a spiral row of strong cilia, which help in locomotion and food gathering. The body is covered with smaller cilia, and may have some spines also. This is one of the larger protozoans. It is found on roots and leaves of water plants.

Coleps hirtus looks somewhat like *Difflugia* because it has a hard shell that resembles a hand grenade. Its shell is of regular construction, consisting of rows of plates arranged in zones. Cilia project through openings between the plates. The mouth is encircled by a row of teeth intermixed with large cilia. *Coleps* occurs in ponds and in hay infusions that have stood a long time.

There are scores of other ciliated protozoans, any one of which you may find under your lens. Some look like paramecia, while others do not look like anything in particular. The best method of making identification, if you want to engage in serious study is to obtain a reliable reference book containing pictures and descriptions.

IN ADDITION to collecting water from ponds, streams, and even the ocean, you can obtain protozoans in a number of other ways. A common one is to make a hay infusion. Simply gather a handful of dry grass or hay, and put it to soak in a jar of water. Usually, water from a pond or stream is better than that from the city mains or a well. After a few days, you ought to have an abundance of microscopic life—along with considerable odor, which you can disregard.

Another way to obtain specimens is to gather half-decayed water-lily or other aquatic-plant leaves and put them in a jar of water for a few days.

Euglena can be produced in abundance by covering some crushed rice with pond water for two weeks. Paramecia can be raised in a culture made by boiling dry water lily leaves for a quarter of an hour, removing (Continued on page 145)



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Hunting Little Big Game with Your Microscope

(Continued from page 144)

floating material, and next day adding water containing paramacia.

Keep infusions and jars of water containing pond life in the light, but not in direct sunlight.

You will find that many protozoans are too lively to be observed in detail. There are various ways of slowing them up. You can make them drunk by adding a drop of very dilute grain alcohol to the water on the slide. Chlorotone can be used instead. A little albumen (white of egg) added to the water will slow the movements. Similar results can be obtained by dissolving gelatin (the kind used for desserts will do) in the water. A network formed of cotton fibers or the fibers of a piece of filter paper will restrict the area of movement of the tiny creatures.

YOU may have difficulty in seeing the delicate flagella or cilia of protozoans. Dark-field illumination will help, if you have the necessary equipment. Another method is to stain the cilia. Noland's staining-fixing solution for this purpose consists of two cubic centimeters of glycerin, forty cubic centimeters of a saturated solution of phenol (carbolic acid) in water, twenty cubic centimeters of formalin, and ten milligrams of gentian violet dye. In mixing, add a few drops of water to the dye, and then add the other materials. Place a drop of this reagent and a drop of the infusion to be studied together on a slide. If staining is too deep, use less reagent in proportion to the water.

Making permanent slides of protozoans is a little more difficult than making slides of simpler specimens such as diatom skeletons, because the tiny creatures must be killed and fixed without distortion.

First it is necessary to trap the protozoans. This is done in the same way that you capture flies with flypaper. Make some albumen fixative as follows: Beat the white of an egg, let it stand a while, and then skin the froth off the top. Filter the remaining liquid through cloth, or through paper with the aid of suction, and add an equal amount of glycerin. To prevent spoiling, introduce a little thymol or salicylate of soda, about a half gram for each twenty cubic centimeters.

SMEAR the slide with this fixative, and drop on the film a little water containing the specimens. Let the water evaporate until the fixative is only slightly moist. Then immerse the slide in the fixing agent, which will kill and "set" the protozoans. A suitable fixer consists of ten cubic centimeters of a saturated solution of corrosive sublimate in water and one cubic centimeter of glacial acetic acid. Fix for several minutes, then stain, dehydrate, and mount in balsam. (NOTE: solutions containing corrosive sublimate are very poisonous. Handle them with great care, and keep them out of the reach of children.)

You can, of course, vary the technique here and there. For instance, instead of dehydrating and mounting in balsam after staining, you can mount in glycerin. Simply put a few drops of dilute glycerin on the slide, and set aside in a dustless place until the water evaporates. Then add the cover glass, seal the edge with paraffin, and finally ring with lacquer.

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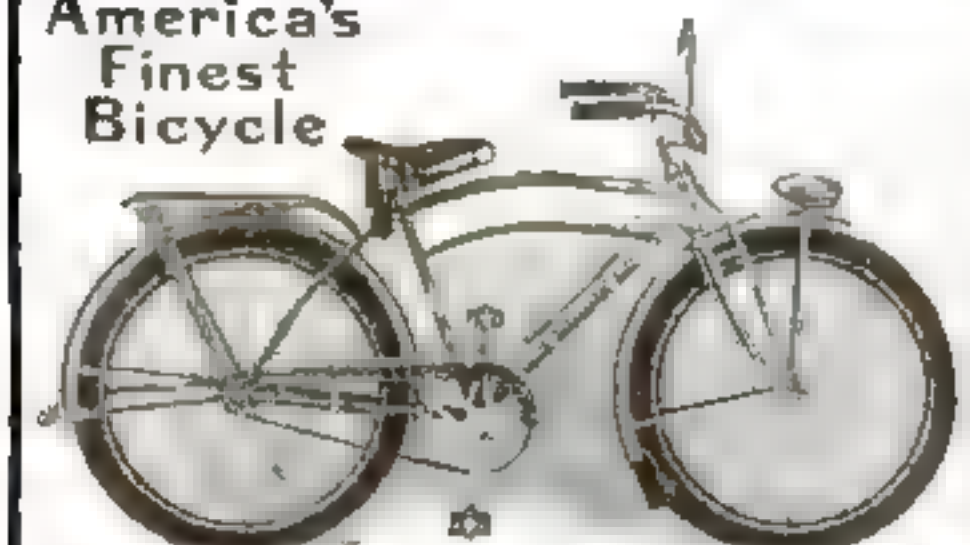


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Natural-Gas Chemistry

(Continued from page 83)

fiery reaction between acetylene and chlorine provides another reminder of the curious fact that oxygen is not essential to produce a flame.

Confined under high pressure, acetylene may decompose and explode in response to heat or shock. Therefore cylinders of acetylene used for metal cutting are not filled merely by pumping in the compressed gas. Instead, they are first packed with asbestos fibers saturated in acetone, a liquid organic chemical that dissolves and thus stores up acetylene introduced under relatively low pressure.

WHAT makes this practical is the remarkable quantity of acetylene gas that acetone will absorb. You can observe the effect for yourself with the aid of an easily assembled bit of apparatus. Attach a four-inch length of rubber tubing to the top of a burette, or to one end of a glass tube two feet long and half an inch in diameter. Arrange two pinch clamps on the rubber tubing, one near each end. Stand the glass column vertically, with the rubber-tubing end upward and the lower end fitted to the stem of a funnel inverted in a bowl of water. Now suck upon the rubber tubing until the burette or glass tube is filled with water, and close the pinch clamps. Place several lumps of calcium carbide in the water under the funnel.

Acetylene gas will be instantly evolved, and the bubbles will rise in the water-filled column, growing smaller and smaller as they approach its top. The bubbles contain some water vapor that is condensing, and the acetylene itself is dissolving in water. Soon, however, the glass tube is filled with the gas. Now open the upper pinch clamp and fill the short section of rubber tubing with acetone. Close the upper pinch clamp, open the lower one, and squeeze the rubber tubing. This will force the acetone down into the acetylene-filled glass tube. As the liquid runs down the walls, it absorbs acetylene. A partial vacuum is created, and atmospheric pressure forces water up into the glass tube to take the place of the acetylene that has been dissolved. A single cubic centimeter of acetone will absorb about twenty-five cubic centimeters of acetylene gas. For comparison, you can repeat the experiment with other solvents that will dissolve acetylene, such as carbon tetrachloride and turpentine.

ETHYLENE, like methane and acetylene, offers interesting possibilities for home experiments. This gaseous hydrocarbon is used in ripening bananas artificially, and is present in illuminating gas. It can be prepared easily in an amateur laboratory.

To generate ethylene, place about thirty cubic centimeters (one fluid ounce) of grain alcohol or denatured radiator alcohol in a flask and add about twenty-five cubic centimeters of strong sulphuric acid. Heat the mixture, and the acid will dehydrate the alcohol or chemically abstract water from it, liberating ethylene gas.

If you use a flask of the distilling type, fit it with a single-hole cork carrying a thistle tube, through which the acid is added. Lead the gas that issues from the side arm, through rubber tubing, to a turned-up glass tube submerged in a pneumatic (Continued on page 147)



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Natural-Gas Chemistry

(Continued from page 146)

trough or gas-collecting basin filled with water. In case your flask has no side arm, fit it with a two-hole cork carrying the thistle tube and also a bent delivery tube of glass leading to the pneumatic trough. Water-filled bottles, inverted in the basin, will collect the gas and may be closed with glass plates until it is used. The gas will burn with a white, luminous flame. You can safely mix ethylene with air in a wide-mouthed bottle and explode it with a lighted match.

STRONG sulphuric acid absorbs ethylene, and you can show this in much the same fashion as you demonstrated how acetone absorbs acetylene—that is, by letting the action create a partial vacuum and draw up water. If you have assembled the handy little gas generator described in a previous article of this series (P.S.M., May '37, p. 68), it will prove especially suitable for this purpose. The device consists simply of a small flask with a two-hole stopper, which carries a separatory funnel and a gas delivery tube leading into an open test tube, the whole being mounted on a base for convenience.

Fill the flask with ethylene, letting the gas pass in through the delivery tube while the stopcock of the funnel is open. Then close the stopcock and arrange the delivery tube of the flask to dip in water placed in the test tube. Put some strong sulphuric acid in the separatory funnel, admit several cubic centimeters of it to the flask, and then close the stopcock again. The acid will absorb the gas, and the vacuum will draw water from the test tube into the flask. If you substitute ordinary illuminating gas for ethylene, you will also be able to observe its loss in volume, though it will be considerably less in this case, since illuminating gas contains only a small percentage of ethylene.

This may be a good point for a word of caution to overzealous home experimenters against the temptation to mix things together indiscriminately and see what will happen. Some hydrocarbons—acetylene, for example—form highly explosive compounds with certain chemicals. Likewise it is perfectly possible to prepare dangerous substances from other easily obtained laboratory materials. Plain common sense should warn any amateur chemist to stick to experiments that he positively knows to be safe, which of course include all of those specifically recommended in these articles.

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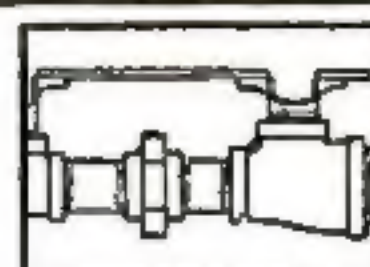
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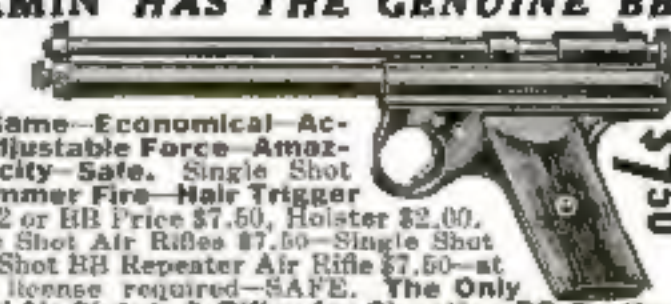
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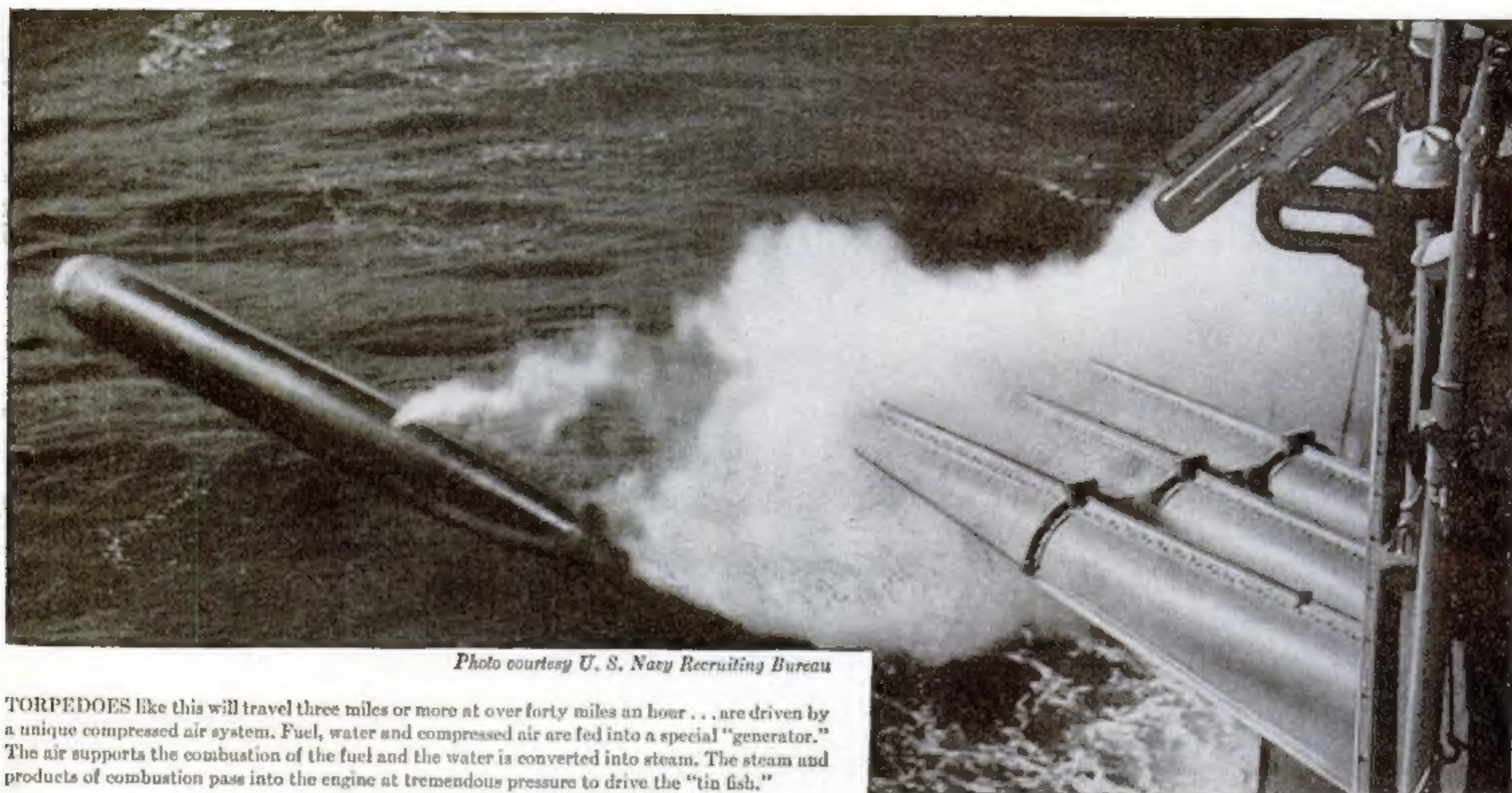


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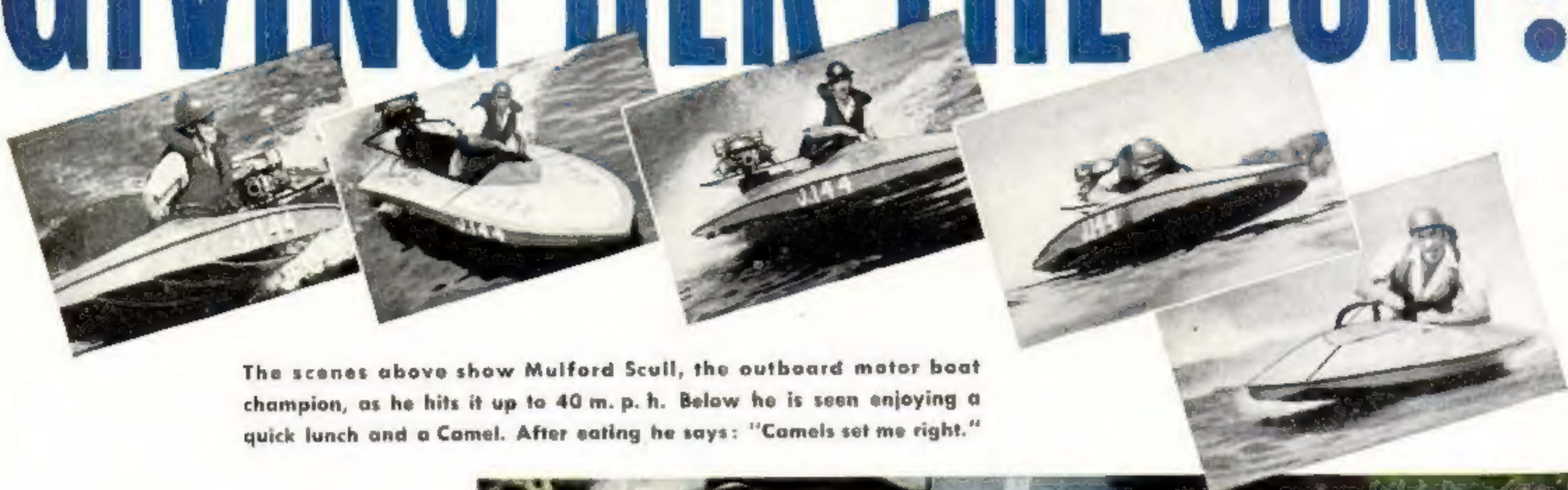
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